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No.

In the Supreme Court of the United States

OCTOBER TERM, 1998

UNITED STATES OF AMERICA, PETITIONER

v.

HUGHES AIRCRAFT COMPANY

ON PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI

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APPENDIX A

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 94-5149, 95-5001

HUGHES AIRCRAFT COMPANY,
PLAINTIFF-APPELLANT

v.

THE UNITED STATES, DEFENDANT/CROSS-APPELLANT

April 7, 1998

Before RADER, Circuit Judge, ARCHER, Senior Circuit Judge,* and BRYSON, Circuit Judge.

ARCHER, Senior Circuit Judge.

This case returns to this court after the Supreme Court's vacatur and remand of *Hughes Aircraft Co. v. United States*, 86 F.3d 1566, 39 USPQ2d 1065 (Fed. Cir. 1996) (*Hughes XIII*), in light of the Court's decision in *Warner-Jenkinson Co. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146 (1997). *See United States v. Hughes Aircraft Co.*, ___ U.S. ___, 117 S. Ct. 1466, 137 L.Ed.2d 680 (1997) (*Hughes XIV*). Because *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 219 USPQ 473 (Fed. Cir. 1983) (*Hughes VII*) satis-

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* Senior Circuit Judge Glenn L. Archer, Jr. vacated the position of Chief Judge on December 24, 1997.

fies the legal requirements announced in *Warner-Jenkinson*, we affirm.

BACKGROUND

Hughes Aircraft Company (Hughes) commenced this suit in 1973 under 28 U.S.C. § 1498, asserting that the United States infringed Hughes' United States Patent No. 3,758,051 issued to Williams (the Williams patent). The Williams patent relates to an apparatus for control over the orientation, or attitude, of a spacecraft using commands from a ground control station. The relevant limitations of claim 1 of the Williams patent read:

> (e) means disposed on said body for providing an *indication to a location external to said body of the instantaneous spin angle position* of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;
>
> (f) and means disposed on said body for receiving *from said location control signals synchronized* with said indication;
>
> (g) said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means *in synchronism therewith* for precessing said body to orient said axis into a predetermined desired relationship with said fixed external coordinate system.

(Emphasis added). In order to correct the attitude of the spacecraft, the ground crew must be able to calculate the instantaneous spin angle (ISA) position. The ISA position is the angle between two specific planes. The first plane, the rotating plane, is defined by the location of the precessing jet and the satellite's axis of rotation. The second plane, the reference plane, is

defined by a fixed reference point in an external coordinate system (such as the sun or another star) and the spin axis. The angle between these planes at a given moment in time is the ISA position with reference to a fixed external coordinate system. Thus, the ISA position generally measures the location of the precessing jet in its rotational cycle relative to the reference plane.

Two pieces of information are needed to calculate the ISA position: the spin rate of the satellite and the instant in time at which the rotating plane passes by the fixed point in the fixed external coordinate system and at which the jet is closest to the fixed reference point. The invention uses onboard sensors to collect this data and then transmits this information to earth to allow the ground crew to determine the satellite's existing and desired orientations. After making the necessary calculations, the ground crew pulses the attitude jet by radio signal commands to precess, or tip, the spin axis of the satellite to the desired position.

In the accused "store and execute" (S/E) craft, the satellite retrieves the same raw data but calculates the ISA position onboard. The spin rate and information to determine the orientation of the satellite is transmitted to the ground. In most of the S/E craft, the satellite does not provide information sufficient to calculate the ISA position.[1] After receiving the spin rate, the ground crew performs the necessary calculations to adjust the attitude of the craft. This information is then sent to and stored in the satellite. The precession does not

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[1] Even for the craft that do supply sufficient data, however, the ground crew does not rely on the information to precess the satellite because the information is retained on board the satellite. Instead, this information appears to be transmitted for research purposes.

occur, however, until the ground crew sends an execute command to the satellite.

In 1982, the then-Court of Claims originally determined, *inter alia*, that the accused S/E devices did not infringe the patent literally or under the doctrine of equivalents. *See Hughes Aircraft Co. v. United States*, 215 USPQ 787, 812 (Ct. Cl. Trial Div. 1982) (*Hughes VI*). On appeal, this court reversed the noninfringement judgment, holding that the S/E devices infringe under the doctrine of equivalents, and remanded for a determination of just compensation. *See Hughes VII*, 717 F.2d at 1366, 219 USPQ at 484. After the decision by the Court of Federal Claims on remand, Hughes appealed, challenging the assessment of damages, and the government cross-appealed, again challenging the liability determination of *Hughes VII* in light of this court's in banc decision in *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 4 USPQ2d 1737 (Fed. Cir. 1987) (in banc). *See Hughes XIII*, 86 F.3d at 1566, 39 USPQ2d at 1066 (Fed. Cir. 1996). This court affirmed the damages determination and refused, under the doctrine of law of the case, to reconsider the *Hughes VII* decision. *See id.* at 1576, 39 USPQ2d at 1072. The Supreme Court, however, granted certiorari, vacated the judgment, and remanded the case (GVR order) to this court for reconsideration in light of its decision in *Warner-Jenkinson*. *See Hughes XIV*, —— U.S. at ——, 117 S.Ct. at 1466.

DISCUSSION

I.

As a threshold matter, we must address the scope of the Supreme Court's GVR order. Generally, the Supreme Court will issue a GVR order:

> [w]here intervening developments, or recent developments that we have reason to believe the court below did not fully consider, reveal a reasonable probability that the decision below rests upon a premise that the lower court would reject if given the opportunity for further consideration, and where it appears that such a redetermination may determine the ultimate outcome of the litigation....

Lawrence v. Chater, 516 U.S. 163, 167, 116 S. Ct. 604, 607, 133 L.Ed.2d 545 (1996) (per curiam); *see also Lords Landing Village Condominium Council of Unit Owners v. Continental Ins. Co.*, —— U.S. ——, ——, 117 S. Ct. 1731, 1732, 138 L.Ed.2d 91 (1997) (per curiam). The use of a GVR order "assists the court below by flagging a particular issue that it does not appear to have fully considered." *Lawrence*, 516 U.S. at 167, 116 S. Ct. at 606. Vacatur and remand by the Supreme Court, however, does not create an implication that the lower court should change its prior determination. *See United States v. M.C.C. of Florida, Inc.*, 967 F.2d 1559, 1562 (11th Cir. 1992) ("The Supreme Court did not take a position on whether *Tull* [v. *United States*, 481 U.S. 412, 107 S. Ct. 1831, 95 L.Ed.2d 365 (1987)] actually affected the outcome of *M.C.C. I*, but was instructing this court to make that determination."); *United States v. National Soc'y of Prof'l Eng'rs*, 555 F.2d 978, 982 (D.C. Cir. 1977), *aff'd*, 435 U.S. 679, 98 S. Ct. 1355, 55 L.Ed.2d 637 (1978).

The government argues that the Supreme Court effectively vacated both *Hughes VII* and *Hughes XIII*; thus, this court is to review anew the trial court's judgment in *Hughes VI*. Hughes responds that only *Hughes XIII* was vacated and that the only issue before this court is whether *Warner-Jenkinson* provides a compelling reason to depart from the law of the case established by *Hughes VII*.

We conclude that the scope of our review on remand is limited to determining whether *Hughes VII* satisfies the legal analysis required by *Warner-Jenkinson*.[2] A GVR order "merely requires further consideration in light of a new Supreme Court decision" and does not "nullify all prior proceedings." *M.C.C.*, 967 F.2d at 1561. Nothing in the petition for a writ of certiorari suggests the sweeping effect posited by the government. Indeed, in its petition, the government argued that "[a]n intervening decision of [the Supreme Court], rather than the court of appeals, obviously would provide a more compelling basis for that court's departure from the law of the case on remand." Petition for Writ of Certiorari at 11 n. 5, *Hughes XIV* (No. 96-1297). Thus, the government itself recognized that its petition was not a request for a vacatur of both *Hughes VII* and *Hughes XIII* but rather was limited to a vacatur of the latter. Had the Supreme Court intended to reinstate the trial court's judgment, it could have explicitly done so. *See Union Pacific R.R. Co. v. Johnson*, 249 F.2d 674, 676 (9th Cir. 1957).

II.

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[2] Because the scope of this remand is limited as such, we decline the government's invitation to revisit the issue of whether the panel in *Hughes VII* engaged in improper appellate fact-finding.

Turning to the merits, we first address the effect of the "all-elements" rule (sometimes referred to as the "all-limitations" rule) enunciated in *Warner- Jenkinson* on the *Hughes VII* decision. The Supreme Court clarified the doctrine of equivalents by noting that:

> [e]ach element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not allowed such broad play as to effectively eliminate that element in its entirety.

520 U.S. at ——, 117 S. Ct. at 1049. Thus, the test for equivalence is to be applied to the individual claim limitations:

> An analysis of the role played by each element in the context of the specific patent claim will thus inform the inquiry as to whether a substitute element matches the function, way, and result of the claimed element, or whether the substitute element plays a role substantially different from the claimed element.

Id. at ——, 117 S. Ct. at 1054; *see Pennwalt*, 833 F.2d at 935, 4 USPQ2d at 1740 (" '[T]he plaintiff must show the presence of every element or its substantial equivalent in the accused device.' To be a 'substantial equivalent,' the element substituted in the accused device for the element set forth in the claim must not be such as would substantially change the way in which the function of the claimed invention is performed." (citations omitted) (quoting *Perkin-Elmer Corp. v. Westinghouse*

Elec. Corp., 822 F.2d 1528, 1532-33, 3 USPQ2d 1321, 1324-25 (Fed. Cir. 1987))).

The government argues that the all-elements rule demands that we depart from the reasoning in *Hughes VII*, in which the court stated that the trial court erred in not "apply[ing] the doctrine of equivalents to the claimed invention as a whole." *Hughes VII*, 717 F.2d at 1364, 219 USPQ at 482. According to the government, to conclude that the claim limitations in paragraphs (e), (f), and (g) are met equivalently by elements in the accused devices would vitiate those claim limitations. The government additionally urges that the arguably corresponding elements of the S/E system differ substantially from the claim limitations by storing the ISA position value onboard in lieu of transmitting an indication of the ISA position to the ground, by not acting in synchronism with the control signals, and by not firing the precession jet within a fixed period of time after receiving the command signal.

Hughes responds that there is no reason to depart from the conclusion reached in *Hughes VII* because *Warner-Jenkinson* did not significantly alter the all-elements rule as stated in *Pennwalt*. Moreover, the *Hughes VII* court, in Hughes' opinion, did perform the required element-by-element analysis mandated by *Warner-Jenkinson*.

We conclude that the analysis performed in *Hughes VII* satisfies the all-elements rule as stated in *Warner-Jenkinson*. Regarding claim paragraph (e), the court in *Hughes VII* concluded that the transmission to the ground crew of the spin rate and information sufficient to calculate the sun angle in the S/E vehicles "is the modern day equivalent to providing an indication of the ISA to the ground. . . ." 717 F.2d at 1365, 219 USPQ at

483. This information, while insufficient to calculate the ISA position, was sufficient to enable the ground crew to control the satellite, which is substantially the same function performed and the identical result achieved by transmitting the indication of the ISA position to the ground. *See id.*

Furthermore, although the information sent is insufficient to calculate the ISA position, this does not demonstrate a substantial difference in the way the element functions. This is a case in which a "subsequent change in the state of the art, such as later-developed technology, obfuscated the significance of [the] limitation at the time of its incorporation into the claim." *Sage Prods., Inc. v. Devon Indus., Inc.*, 126 F.3d 1420, 1425, 44 USPQ2d 1103, 1107 (Fed. Cir. 1997); *cf. Warner-Jenkinson*, 520 U.S. at ——, 117 S. Ct. at 1053 ("Insofar as the question under the doctrine of equivalents is whether an accused element is equivalent to a claimed element, the proper time for evaluating equivalency . . . is at the time of infringement, not at the time the patent was issued."); *Pennwalt*, 833 F.2d at 938, 4 USPQ2d at 1742 ("[T]he facts here do not involve later developed computer technology which should be deemed within the scope of the claims to avoid the pirating of an invention."). The court in *Hughes VII* determined that the change in the S/E devices was the result of a technological advance not available until after the patent issued. *See Hughes VII*, 717 F.2d at 1365, 219 USPQ at 483. Relying on testimony of one of skill in the art at the time of infringement, the court in *Hughes VII* concluded that this advance resulted in an insubstantial change in the way the element performed its function. *See id.* (citing testimony that an engineer would realize that transmission

of the ISA position was no longer necessary as a result of the change in technology).

The court in *Hughes VII* also concluded that the "synchronism" limitations in paragraphs (f) and (g) were also equivalently met by the accused devices. Again, as a result of an advance in technology, the satellite system was able at the time of infringement to store the precession information and to wait to precess the satellite until receipt of the execute command. Thus, the synchronism in the accused device is coordinated by the computer instead of by real-time execution of the command from the ground. As recognized in *Hughes VII*, "[t]he difference between operation by retention and operation by sending is achieved by relocating the function, *making no change in the function performed, or in the basic manner of operation, or in the result obtained.*" *Id.* at 1366, 219 USPQ at 484. The court in *Hughes VII* correctly performed an analysis of the function, way, and result of the individual elements in the accused devices and concluded that these elements equivalently met the claim limitations at issue.

Accordingly, we conclude that *Warner-Jenkinson* provides no basis to alter the decision in *Hughes VII* because the court properly applied the all- elements rule.

III.

We now turn to the issue of *Warner-Jenkinsons'* impact on the doctrine of prosecution history estoppel. The Supreme Court concluded in *Warner-Jenkinson* that

> [p]rosecution history estoppel continues to be available as a defense to infringement, but if the patent-

> holder demonstrates that an amendment required during prosecution had a purpose unrelated to patentability, a court must consider that purpose in order to decide whether an estoppel is precluded.

520 U.S. at ——, 117 S. Ct. at 1054. The Court articulated a rebuttable presumption of prosecution history estoppel that arises whenever an amendment to a claim is made but the reason for that amendment is not known from the intrinsic evidence.

The government argues, however, that *Warner-Jenkinson* further requires prosecution history estoppel to act as an absolute bar, and thus to preclude *any* equivalents to a claim limitation that was added to overcome a patentability rejection, regardless of what subject matter was surrendered. The patentee thus would be limited to the literal scope of the particular claim limitation. For support, the government relies on the following statement in *Warner-Jenkinson* in which the Supreme Court addressed the newly articulated rebuttable presumption:

> Mindful that claims do indeed serve both a definitional and a notice function, we think the better rule is to place the burden on the patent-holder to establish the reason for an amendment required during patent prosecution. The court then would decide whether that reason is sufficient to overcome prosecution history estoppel as a *bar to application of the doctrine of equivalents* to the element added by that amendment. Where no explanation is established, however, the court should presume that the PTO had a substantial reason related to patentability for including the limiting element added by amendment. In those circumstances, prosecution

> history estoppel would *bar the application of the doctrine [sic, of] equivalents* as to that element.

Id. at ——, 117 S. Ct. at 1051 (emphasis added). Thus, the government urges that Hughes should be precluded from asserting any equivalents to paragraphs (e), (f), and (g) because these limitations were added to overcome prior art.

Hughes responds that, aside from the rebuttable presumption, the Supreme Court did not alter this court's prosecution history estoppel analysis, which previously rejected the bright-line rule posited by the government. According to Hughes, such an approach is inconsistent with the requirement that the reasons for an amendment are to be considered.

We reject the government's contention that *Warner-Jenkinson* requires such a wooden approach to prosecution history estoppel. The Supreme Court has long recognized that the key to prosecution history estoppel is the surrender or disclaimer of subject matter by the patentee, which the patentee is then unable to reclaim through the doctrine of equivalents. *See Exhibit Supply Co. v. Ace Patents Corp.*, 315 U.S. 126, 136, 62 S. Ct. 513, 518-19, 86 L.Ed. 736 (1942) ("By the amendment he recognized and emphasized the difference between the two phrases and proclaimed his abandonment of all that is embraced in that difference. The difference which he thus disclaimed must be regarded as material, and since the amendment operates as a disclaimer of that difference, it must be strictly construed against him." (citations omitted)); *see also Sutter v. Robinson*, 119 U.S. 530, 541, 7 S. Ct. 376, 381-82, 30 L.Ed. 492 (1886) ("He is not at liberty now to insist upon a construction of his patent which will include what he was expressly

required to abandon and disavow as a condition of the grant.").

In evaluating the reason behind an amendment, a court must determine what subject matter the patentee actually surrendered. *See Warner-Jenkinson*, 520 U.S. at —— n. 7, 117 S. Ct. at 1051 n. 7 ("What *is* permissible for a court to explore is the reason (right or wrong) for the objection *and the manner in which the amendment addressed and avoided the objection.*" (latter emphasis added)); *see, e.g., Roemer v. Peddie*, 132 U.S. 313, 317, 10 S. Ct. 98, 99, 33 L.Ed. 382 (1889) (finding no infringement because the patentee had confined his claim to "an arrangement not found in the defendants' structure" to obtain its allowance); *Shepard v. Carrigan*, 116 U.S. 593, 597, 6 S. Ct. 493, 494-95, 29 L.Ed. 723 (1886) (finding no infringement because the accused skirt protector lacked plaited or fluted bands to which the patentee had limited her claim to distinguish the prior art); *see also LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 867 F.2d 1572, 1576, 9 USPQ2d 1995, 1999 (Fed. Cir. 1989); *Bayer Aktiengesellschaft v. Duphar Int'l Research B.V.*, 738 F.2d 1237, 1243, 222 USPQ 649, 653 (Fed.Cir.1984). If the accused device wholly fails to meet a limitation to which the patentee has expressly limited the claims, a finding of equivalence is precluded under prosecution history estoppel.

We conclude, however, that no such estoppel arises here. The PTO originally rejected Hughes' claim for obviousness in light of U.S. Patent No, 3,216,674, issued on November 9, 1965 to McLean (the McLean Patent). In response to this rejection, Williams canceled his original claims and inserted, *inter alia*, the claim that issued as claim 1 and contained the limitations in

paragraphs (e), (f), and (g).[3] The McLean patent relates to a space vehicle with a self-contained navigation system that maintains a collision course with a target body. As the target body changes its position, the McLean vehicle automatically alters its course relative only to the target. Although the vehicle disclosed in the McLean patent precesses in the same fashion as the Williams invention, it differs from the Williams vehicle by performing precession without two-way communication with an external location and without reference to a fixed, external coordinate system. Williams' amendments thus did not surrender subject matter covering a device, such as the accused device, which provides two-way communication with an external location (although some calculations are made onboard instead of at the external location) and which uses an external coordinate system.

Because these amendments to the claim language were made to overcome a prior art rejection, they do serve to narrow the range of equivalents; however, they do not preclude all equivalents available to Hughes. *See Hughes VII*, 717 F.2d at 1363, 219 USPQ at 482. Because the accused device does not fall within the range of subject matter surrendered, prosecution history estoppel does not preclude infringement under

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[3] Because the reason for the amendment, to overcome the PTO's obviousness rejection in light of the McLean patent, is clear from the prosecution history the rebuttable presumption of prosecution history estoppel does not arise in this case. *See Warner-Jenkinson*, 520 U.S. at ——, 117 S. Ct. at 1051; *see also Hilton Davis Chem. Co. v. Warner- Jenkinson Co.*, 114 F.3d 1161, 1163, 43 USPQ2d 1152, 1153 (Fed. Cir. 1997) (in banc) (noting that the presumption arises when "the prosecution history does not reveal the reason for the change").

the doctrine of equivalents. *See id.* at 1362, 717 F.2d 1351, 219 USPQ at 481.

IV.

We note that the Supreme Court vacated *Hughes XIII* in its entirety, including our determinations regarding damages. A lower court, however, is "free to adopt any or all of [the prior decision] that, upon reconsideration, it determine[s] to be unaffected by [the relevant Supreme Court case]." *M.C.C.*, 967 F.2d at 1561. Because *Warner-Jenkinson* did not affect our decision regarding damages, we reinstate those portions of *Hughes XIII*. See *M.C.C.*, 967 F.2d at 1562.

CONCLUSION

Because the decision in *Hughes VII* satisfies the requirements of *Warner-Jenkinson*, we affirm the judgment of the Court of Federal Claims. We reinstate the determinations of *Hughes XIII* as they relate to damages.

AFFIRMED.

APPENDIX B

UNITED STATES COURT OF CLAIMS
TRIAL DIVISION

No. 426-73

HUGHES AIRCRAFT COMPANY

v.

UNITED STATES

Decided Sept. 1, 1982

OPINION*

COLAIANNI, Trial Judge.*

The Hughes Aircraft Company seeks reasonable and entire compensation, pursuant to 28 U.S.C. § 1498, for the unlicensed use of United States Patent No. 3,758,051 (hereinafter "the Williams patent").[1] In an

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* The trial judge's recommended decision and conclusion are submitted in accordance with Rule 134(h).

[1] The patent in suit, United States Patent No. 3,758,051 for velocity control and orientation of a spin-stablized body, was issued to Donald D. Williams on September 11, 1973, on an application filed August 21, 1964. This patent is a continuation-in-part of Serial No. 22,733, filed April 18, 1960, now abandoned.

earlier recommended decision and conclusion of law (Hughes Aircraft Co. v. United States, 205 USPQ 381 (1979)), I found that the Williams patent was invalid under 35 U.S.C. § 102(b). On appeal, this court, in Hughes Aircraft Co. v. United States, 226 Ct. Cl. ——, 640 F.2d 1193, 208 USPQ 785 (1980), found that "the Williams patent is not invalid under 35 U.S.C. § 102(b)," and remanded the case to me for "a recommended decision and findings on the other issues presented." *Id.* at 1199, 208 USPQ at 791.

The Williams patent relates to a general attitude control system (ACS) for spacecraft first used in the Hughes manufactured Syncom II and Syncom III satellites, the world's first synchronous communications satellites. This invention was allegedly used for and/or manufactured by or for the United States in the Skynet II, NATO II, DSCS II, IMP (H and J), Solrad (9 and 10), and Pioneer (10 and 11) systems. The Government denies infringement, and disputes the validity and enforceability of the Williams patent. For reasons discussed below, I find that the Williams patent is valid and enforceable and that of the accused systems the Solrad (9 and 10) and Pioneer (10 and 11) systems infringe that patent.

The Communications Satellite Design Problem

An early goal of the space program was the development of a synchronous communications satellite.[2] A network of such satellites was contemplated to enable worldwide radio coverage of events.

In the late 1950's and early 1960's the launch vehicles used for propelling rockets were of limited capacity and capable of lifting only the smallest of payloads. Accordingly, designers in the early days of satellites were necessarily obsessed with weight considerations. To economize on power and weight, the communications satellites were equipped with directional antennas. Ironically, elaborate pointing systems seemed necessary to keep the earth within the narrow antenna beams. These systems, which employed three sets of gyroscopes and rocket motors (three-axis ACS), proved too heavy to be lifted into synchronous orbit by the available launch vehicles.

Developments at Hughes

The use of jet vanes, spin noozzles, or spin rockets, to rotate various stages of the rocket used to convey a satellite into orbit about its longitudinal axis for stability, was well known. As a result, a satellite will have a spin imparted to it as it assumes its spacial orbit. Hughes' engineers, Harold A. Rosen and Donald D. Williams, realized that the continual correction of a satellite's attitude was unnecessary, since the orienta-

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[2] A radio communication satellite must be placed in a west-to-east circular orbit in the earth's equatorial plane, and have a period of 24 hours. In order to "hover" above a single point on earth, the satellite must be placed in an orbit having a 22,750-nautical-mi. radius from the center of the earth and travel around the orbit at a linear velocity of 10,090-ft. per second.

tion of a spinning satellite with respect to a fixed external coordinate system is not affected by its orbital motion.

Despite the advantages of spin stabilization, Hughes faced numerous formidable hurdles that had to be overcome in order to ensure acceptable communication between the high altitude orbital position of the satellite and earth. In the first place, the satellite transmitter required a certain degree of antenna directivity. A "pancake" beam antenna was selected as the simplest technique compatible with spin stabilization. This type of antenna radiates a beam which is at maximum intensity along a plane perpendicular to the axis of the antenna. For this reason, the pancake beam antenna is useful only when the earth is in the plane of the pancake beam. Thus, to obtain continuous maximum antenna gain, the spin axis of the satellite, with which the axis of the antenna is coincident, must be normal to the plane of the orbit. Moreover, the array of glass-coated solar cells which covered the exterior of the satellite and acted as the satellite's power supply required as much exposure to the sun as possible.

For ballistic reasons, a communications satellite will be injected into orbit with its spin axis lying in its orbital plane. Thus, to maximize gain from the pancake beam antenna and to optimize performance from the solar cell power supply, it is necessary to reorient the spin axis of the satellite through 90°. For this reason, Messrs. Rosen and Williams suggested that the satellite be equipped with a set of spin jets, which, when pulsed, would cause the satellite to spin about the antenna axis. Reorientation would consist of stopping the old spin and initiating the new.

The Rosen-Williams ACS was described in a patent application filed December 30, 1959, and issued as patent No. 3,396,920 on August 13, 1968. The inventors recognized that theirs was not a complete solution to the attitude control problem, since, among other things, solar radiation and magnetic fields would gradually disturb the orientation of the satellite, and their ACS reorientation capabilities were limited.

Subsequent work by Mr. Williams led to the realization that a single jet, mounted parallel to the antenna axis, but offset therefrom, could be used to precess[3] a satellite into a desired orientation. The Williams system achieved greatly improved results over the Rosen-Williams ACS.

The first written description of the invention appeared in a January 1960 confidential report on the status of Hughes' Commercial Communication Satellite (Comsat). This report disclosed a spin-stabilized satellite equipped with a directional antenna, a V-beam sun sensor, and a ground commandable precessing jet.

The Original Williams Application

On April 18, 1960, Williams filed the parent application on the invention in suit. This application contained essentially the same Figs. 1-11, and their accompanying descriptions as are found in the patent in suit. It did not, however, contain either Fig. 12, nor the accompanying description.

The 1960 application described a method and apparatus for controlling the orientation of the spin axis of a spin-stabilized space vehicle. As an exemplary embodi-

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[3] Precession is the change in the orientation, with respect to an external reference frame, of the spin axis of a spinning body.

ment of the invention, the specification and drawings presented an earth-orbiting, spin-stabilized satellite. The satellite was equipped with a pancake beam directional antenna, a V-beam sensor, a radio transmitter for transmitting information detected by the sensor to the earth, an axial fluid jet offset from the spin axis for correcting the attitude, and a radio receiver hooked up to activate the fluid jet when the proper signal is received. No specific earth-based remote control device was disclosed. However, the 1960 application indicated that any of several remote control systems that were well known in the art could be used.

Obviously, before any correction in attitude takes place, it is necessary to find the present orientation of the satellite. Having determined its present orientation and knowing the desired orientation, the required amount of attitude correction can be established. Attitude or orientation sensing is not only needed to establish the amount of correction required, but also to repeatedly pulse the attitude correction jet at the proper phase in the spin cycle to achieve the desired correction in attitude. The 1960 application provided for both solar and radio frequency sensing of attitude.

A V-beam sun sensor, which was well known in the art at the time of the Williams invention, was used as the solar orientation sensing device. It measured the sun angle, the angle between the satellite's spin axis and the satellite's sun vector (the sun line), and the spin angle position, the degree of rotation of the jet past the sun line. This information is transmitted to a ground-based control station by means of a directional antenna and provides two of the needed three attitude angles required to establish the geometric position of the satellite in space.

The 1960 application, in addition, indicated that the directional antenna could also be used as an orientation means.

As to the disclosed means for sensing the orientation of the satellite, * * * it will be understood that other means may be provided. For example, asymmetry may be deliberately introduced into the antenna radiation pattern of the satellite.[4]

Once the desired precession maneuver is calculated, the necessary control signals are sent up to the satellite. These control signals are synchronized with the spin cycle of the satellite, and, as a result, the precessing jet is activated at the proper phase of the spin cycle. The specification makes clear that the spin angle indication provided by the solar sensor is used as a time reference for these control signals.

In operation, precession is accomplished, as explained in the 1960 application, by the reactive force produced by the jet of nitrogen gas which is expelled by the attitude control nozzle. (See col. 8, lines 17-41, of the Williams patent.) A thrust is applied parallel to the spin axis and near the periphery of the satellite. In this manner, a net torque is produced around an axis perpendicular to the spin axis of the satellite. By periodic pulsing of the attitude control jet for a predetermined portion of a spin cycle of the satellite, with a synchronized control signal, a torque is applied to precess the spin axis in the direction of the desired correction. Pulsing of the control jet is continued in subsequent spin cycles until the spin axis of the satellite is precessed through 90° and it is parallel to the earth's axis. The spin axis of the satellite can be corrected

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[4] Col. 11, lines 9-15, of the Williams patent.

immediately after the launch operation or at any other time in order to maintain the spin axis parallel to the earth's axis.

The 1960 application presented nine claims to the Patent and Trademark Office for consideration by the examiner. As an aid to understanding the examiner's position in later actions, the language of original claim 2 is instructive. Claim 2 claimed a body with a spin axis, a source of pressurized gas, a jet disposed on the body parallel to and spaced from the spin axis, a controllable value connecting the gas to the jet, and "control means coupled to said valve for actuating said valve in pulses synchronized with the spin of said body." Comparing this claim language with the example disclosed by the application, it is clear that the "control means" necessarily encompasses the remote control system, including some sort of ground controller. This is because, as disclosed, the remote control system is an indispensable link in the loop providing the synchronization between the sensing of the spin angle position of the body and the pulsing of the jet valve needed for controlled precession. Since the examiner at the Patent and Trademark Office before whom the application was pending made no objection to claim 2 under the first paragraph of 35 U.S.C. § 112,[5] it must be assumed he felt that the broad recitation of ground controller in

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[5] 35 U.S.C. §112, first paragraph:

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention."

that claim, as well as all of its other elements, was supported by the original disclosure.

Following the first two office actions by the examiner, plaintiff, on January 3, 1963, cancelled claim 2 and filed new claims 15-19 in its pending application. These claims, in applicant's own words, "are drawn to applicant's apparatus for changing the attitude and translational velocity of a spin- stabilized body * * *." Applicant argued that the following language of claim 15 was patentably distinct over the art of record:

> [C]ontrol means coupled to said valve for actuating said valve in a series of pulses occurring once per each revolution of said body about said axis and whose starting and stopping times are determined by the instantaneous angle of rotation of said body about said axis with respect to a reference point in space to produce a series of incremental forces that result in a net force on said body in a predetermined direction.

Applicant also maintained that claim 16 was patentable over the cited prior art, since it called for:

> [M]eans associated with said body for expelling fluid more than once from a particular location thereon to exert a series of incremental forces on said body during several revolutions of said body about said axis, said means controlling the duration of each expulsion of fluid to be short compared to the time of one revolution of said body about said axis, said means controlling the time of occurrence of each expulsion of fluid to be at a predetermined part of the cycle of revolution of said body about said axis.

> The plaintiff made similar arguments in connection with claims 17-19.

In the next and final office action of December 24, 1963, the examiner rejected these claims as being drawn to an inadequate disclosure. He stated:

> Claims 15-19, newly presented, are rejected as drawn to an inadequate disclosure. There is nothing in the original disclosure to indicate how the starting and stopping time or duration of the pulses is determined by the instantaneous angle of revolution of the body with respect to a reference point. The signals from 71 and 73 are sent by 90 and 50 to earth or another planet but there is no disclosure as to how such information is converted and used to send back to 90 for control of 93.

The examiner here is referring to the requirements of the first paragraph of 35 U.S.C. §112.[6]

In response to this rejection, Hughes on June 22, 1964, filed an amendment after final rejection, wherein it requested that the Patent and Trademark Office permit it to amend the specification and claims 15-19 of its pending application. The examiner declined to enter the amendment, maintaining that it would introduce new matter into the case, since there was no support for the changes requested in the original specification, and that the proposed amendment would not, in any event, remedy the inadequacy of the disclosure. On June 23, 1964, Hughes filed a notice of appeal of the examiner's decision, but the appeal was never perfected.

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[6] *Id.*

The Continuation—in—Part Application

On August 21, 1964, Hughes filed a continuation—in—part (CIP) application based upon the original application of April 18, 1960. It is this CIP application[7] from which the patent in suit ultimately matured. Plaintiff then permitted the original parent application to go abandoned.

Plaintiff's CIP application retained the disclosure of the 1960 parent application described above and added some material. This material consisted of Fig. 12 and the portion of the specification relating thereto. Figure 12 shows a ground-based analog controller for synchronizing the control signals it generates with the spin of the satellite. A rotating drum, formed with a raised cam section, is the analog element disclosed. The spin angle information provided by the sun sensor is used to match the drum's phase of rotation to the rate of spin of the satellite. A fixed switch is positioned such that contact between the leading edge of the cam and the fixed switch coincides with the ground reception of the solar sensor pulse. The speed of the drum is adjusted until such a coincidence occurs. Upon achieving this, the drum has been synchronized with the spin of the orbiting satellite. In addition, a movable switch is positioned such that its closure transmits a control pulse to the satellite for actuation of the attitude adjustment valve.

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[7] A CIP application usually contains additional material not found in the original application. If the CIP complies with 35 U.S.C. §120, the originally disclosed subject matter is entitled to the filing date of the original application. However, any new matter added in the CIP is entitled to only the filing date of the CIP application.

This analog controller had previously been described in a paper delivered by a Hughes employee (Roger W. Cole) to the 18th Annual Meeting of the Institute of Navigation, June 18-20, 1962.

When originally filed, plaintiff's CIP application presented claims 1-18 for the examiner's consideration. Claims 4-7, 10 and 13 each recited "control means" using language very similar to the language discussed previously in connection with claims 15-19 of the 1960 application. In the first office action following plaintiff's filing of the CIP, the examiner held that claims 4-7, 10 and 13 were not supported by the disclosure of the parent (1960) application. The examiner then rejected these claims under 35 U.S.C. § 102(b) because the invention was identically disclosed in a paper published more than one year prior to the filing date of the CIP application by one of plaintiff's own employees, Roger W. Cole. The examiner specifically stated that:

> The subject matter of applicant's Fig. 12, relating to the means for controlling the starting and stopping times, and duration, of control valve actuation, so as to be in synchronism with body rotation, as determined by a function of the instantaneous angle of rotation of the body with respect to a reference in space, is entitled to the filing date of the instant application only. Thus, Cole's disclosure operates as a statutory bar against such matter, as claimed, under 35 U.S.C. 102(b).

The examiner here was objecting to the details of the control means recited in claims 4-7, 10 and 13 which he felt were not disclosed in the parent application. T he examiner was not making a finding that the disclosure of the original application would not enable one skilled

in the art to use the satellite. Had he made such a finding, he would have rejected all the claims under 35 U.S.C. § 112, first paragraph, not just those reciting the objectionable details.

In response, plaintiff, by its July 21, 1965, amendment, cancelled claims 4, 6 and 7, and amended the "control means" portion of each of claims 5, 10 and 13 such that the recitation closely tracked that of originally filed claims 2 (of the 1960 parent application) discussed previously. With regard to the rejections based on Mr. Cole's article, plaintiff stated:

> Claims 5, 10, and 13 were rejected as being fully met by the Navigation article by Cole under 35 USC 102. Claims 5, 10 and 13 have been amended to delete reference to the control of starting and stopping times and the duration of valve actuation. Accordingly, Cole's disclosure cannot now be considered to operate as a statutory bar against claims 5, 10 and 13.

In the next office action the examiner, apparently in agreement with plaintiff, dropped the rejection based on the Cole reference. However, all of the pending claims were finally rejected as being unpatentable over the newly cited patent to McLean (U.S. Patent No. 3,216,674) in view of a previously cited patent to Geyling (U.S. Patent No. 2,991,027) under 35 U.S.C. § 103. In response, Hughes cancelled the rejected claims and inserted, by amendment, new claim 19-21 into the application. These claims were allowed by the examiner without comment and became claims 1-3 of the patent in suit. It must be assumed then, that the examiner felt these claims too were entitled to the April 18, 1960, filing date of the original application.

The CIP application issued as the Williams patent (the patent in suit), consisting of the three claims (1-3) allowed, as described above. Claim 1, the broadest claim in suit, reads as follows:

1. Apparatus comprising:

   a. a body adapted to spin about an axis;

   b. fluid supply means associated with said body;

   c. a valve connected to said fluid supply means;

   d. fluid expulsion means disposed on said body and coupled with said valve andoriented to expel said fluid substantially along a line parallel to said axis and separated therefrom;

   e. means disposed on said body for providing an indication to a locationexternal to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;

   f. and means disposed on said body for receiving from said location controlsignals synchronized with said indication;

   g. said valve being coupled to said last-name means and responsive to saidcontrol signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

Claim 2 differs from claim 1 in that the clause (e) "means" of claim 1 is recited in clause (f) of claim 2 as "wide angle means." In claim 3, element (e) of claim 1 is further limited to "wide angle optical means." The other limitations recited in claims 2 and 3 are not material to this litigation.

The court in *Hughes Aircraft Co. United States*, 226 Ct. Cl. —, 640 F.2d 1193, 208 USPQ 785 (1980), found that none of claims 1-3 include a ground controller as an element.

Scope of Remand

As mentioned previously, the court on review concluded that the patent in suit was not invalid under 35 U.S.C. § 102(b), and remanded the case to me for a recommended decision on the "other issues." *Id.* at ——, 640 F.2d at 1199, 208 USPQ at 791. Defendant argues that although the court's decision clearly precludes one path by which 35 U.S.C. § 102(b) can be found to invalidate the patent, other paths have been left open and must be dealt with on remand. For the reasons discussed hereinafter, it is concluded that the court's decision has precluded any further consideration of 35 U.S.C. § 102(b) issues.

In order to understand the questions involved, it is useful to recall that my original decision was reached in three steps. First, I found that the ground control device shown in Fig. 12 of the patent was a claimed element of all three claims. Next, I found that these claims were only entitled to the filing date of the continuation—in—part application (which matured into the patent in suit). This was because the parent application failed to provide sufficient support in

accordance with 35 U.S.C. §§ 120[8] and 112, first paragraph, for the claims as I interpreted them. Finally, I concluded that the claims were invalid under 35 U.S.C. § 102(b) because the invention was described in a printed publication more than one year before the filing date of the CIP application.

On review, the court, to the contrary, found that the ground control device was not a claimed element in any of the three claims.

> The claims of the patent cover solely the orbiting satellite and no other object, device, means, or apparatus.

640 F.2d at 1195, 208 USPQ at 788. This alone could have been the basis of the court's decision. Had the court said nothing more, the defendant could have argued that even though no ground controller is claimed, the patent is still not entitled to the filing date of the parent (1960) application under 35 U.S.C. § 112, first paragraph, and thus is invalid under 35 U.S.C. § 102(b) due to the intervening Cole publication.

The law is clear that in order for plaintiff to be successful in claiming that the patent is entitled to the

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[8] 35 U.S.C. §120 provides:

"An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States by the same inventor shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application."

filing date of the parent (1960) application under 35 U.S.C. § 120, the disclosure of the parent application must be sufficient to enable one skilled in the art to make and use the claimed invention as required by 35 U.S.C. § 112, first paragraph. It is, of course, possible that although the disclosure might enable one skilled in the art to make the satellite, the disclosure might not be sufficient to enable one skilled in the art to use the satellite. If the Fig. 12 ground controller material added in the CIP application is found to be needed to enable one skilled in the art to use the satellite, then the Williams patent would be entitled to the earlier parent (1960) application date even though the ground controller is not part of the invention.

However, the court went on to conclude that:

> The Williams patent is not invalid under 35 U.S.C. § 102(b). The case is remanded to Trial Judge Colaianni to file a recommended decision and findings on the other issues presented.

640 F.2d at 1199, 208 USPQ at 791. In order to support this conclusion, the court, of necessity, must have found that the parent (1960) application complied with the first paragraph of 35 U.S.C. § 112. This is because, as explained above, in order to avoid invalidity under 35 U.S.C. §102(b), the patent must be entitled to the parent (1960) application filing date. In order to be so entitled, 35 U.S.C. §120 requires that the parent application comply with the first paragraph of 35 U.S.C. §112. Thus, defendant is precluded from arguing that the parent disclosure is not enabling in accordance with the first paragraph of 35 U.S.C. §112.

Further support for this position can be found in the changes the court made to finding of fact 97. The

finding was changed to read that the additional material added to the CIP (Fig. 12 and the accompanying description) was not "new material." As far as can be determined, there is no distinction between "new material" and the term of art "new matter." This is now the law of this case. Since no new matter was added in the CIP, all that additional material must be inherent in the disclosure of the parent application. Priesmeyer v. Rudy, 411 F.2d 796, 798, 161 USPQ 776, 778 (CCPA 1969); Textronix, Inc. v. United States, 195 Ct. Cl. 53, 59, 445 F.2d 323, 326- 27, 165 USPQ 392, 394, 170 USPQ 100 (1970). Thus, any claims supported by the CIP would be equally supported by the parent application.

Defendant, however, argues that the following comment in the court's decision, as a matter of law, invalidates the patent:

> The problem with the original application * * * was * * * the failure * * * to give sufficient information regarding the ground control device to enable one skilled in the art to practice the invention.

640 F.2d at 1198, 208 USPQ at 790. Although the court's language does appear to track the requirements of the first paragraph of 35 U.S.C. § 112, it was made in a discussion explaining why the plaintiff amended the application. In this context it is clear that "the invention" referred to is the invention claimed early in the prosecution of the CIP application, not the invention finally allowed. As discussed previously, the examiner found this invention to be supported only by the added material of the CIP disclosure, and not entitled to the filing date of the parent application. CIP claims 4-7, 10 and 13 were thus rejected under 35

U.S.C. § 102(b) over the intervening Cole publication. However, when the claims were amended to recite the "control means" in a manner similar to the way it was recited in claim 2 of the original parent application, the Cole rejection was dropped and never raised again. Clearly, the examiner felt that the claimed invention that was finally allowed was properly supported by the parent application. If he had felt otherwise, he would have repeated the Cole rejection.

In the same statement quoted above, the court refers, without qualification, to "the problem with the original application * * *." While this may appear to indicate that the court felt that there was a problem with the patent application originally filed, a reading of the entire decision clearly dispels any such interpretation. This is made particularly clear when it is recalled that the court found that the CIP application added no new matter. The court was merely explaining what the problem was in the eyes of the examiner.

35 U.S.C. § 112

As explained above, this court's earlier decision precludes consideration of any contention that the parent application fails to satisfy the "description," "enablement" or "best mode" requirements of the first paragraph of 35 U.S.C. § 112. If the parent application satisfies these requirements, then so does the CIP application, because the CIP application included all of the disclosure of the parent application. Consideration of the second paragraph requirement of 35 U.S.C. § 112 that the claims must particularly point out and

distinctly claim the invention has, however, not been precluded by the court's decision.[9]

Defendant argues that the claims of the Williams patent are invalid under 35 U.S.C. § 112, second paragraph, because without the ground controller as an element, the claimed combination is inoperative. In support of this argument, defendant cites this court's decision in General Electric Co. v. United States, 215 Ct. Cl. 636, 653, 572 F.2d 745, 755, 198 USPQ 65, 73 (1978). Although General Electric did find some claims to be invalid under 35 U.S.C. § 112 due to inoperativeness, the rationale of that decision is not applicable to the case at bar.

In General Electric, this court was presented with claims to a servo-control system of the type used on battleships to drive a gun and turret in unison with the movement of a sighting telescope. The invention was directed to solving the oscillation problems in such systems commonly known as "hunting" wherein the gun, due to inertia and time lags, oscillates about the position of correspondence with the telescope. In order to function properly, the anti- hunting means of the invention had to generate a modifying signal only when the current of the drive motor was changing. Claims 35 and 36 were interpreted by the court as requiring that the anti-hunting means be directly connected to a direct

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[9] The second paragraph of 35 U.S.C. §112 provides:

"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or dependent form, and if in dependent form, it shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim."

current drive motor because a transformer was not included as an element of either of the claims. Id. at 651, 572 F.2d at 753-54, 198 USPQ at 72. The court stated that:

> [W]ithout transformer 81, or some equivalent means, the claimed combination is inoperative since there would be nothing to prevent the generation of a modifying signal by anti-hunting means 55 under constant current drive motor conditions. Since the combination as claimed is inoperative for its claimed purpose, the patentee has failed to distinctly claim the disclosed invention as required by the second paragraph of 35 U.S.C. §112. * * * Accordingly claims 35 and 36 are invalid.

215 Ct.Cl. 653, 654, 572 F.2d at 755, 198 USPQ at 73.

Defendant compares the omission of the ground controller in the claims of the Williams patent with the omission of the transformer 81 in *General Electric* and concludes that the claims of the Williams patent are inoperative. However, the omission in General Electric caused the claims there to define a device that would generate a modifying signal when no modifying signal should have been generated. The device as claimed would have been unsuitable for the claimed purpose. In contrast, it is clear that the satellite defined by the claims of the Williams patent would operate properly in accordance with the claimed purpose. All that is needed to use the satellite defined by the claims is a ground controller.

The defendant's argument then boils down to the argument that because the satellite needs a ground controller in order to be used, a ground controller must be claimed. This position has already been dealt with

by this court in Hughes Aircraft Co. 220 Ct. Cl. ——, 640 F.2d at 1197, 208 USPQ at 789, where it is stated that "it is not necessary to claim in a patent every device required to enable the invention to be used."

Defendant further argues that the claims are invalid under 35 U.S.C. § 112, second paragraph, because they are mere aggregations of elements. An aggregation occurs where a claim recites two or more elements without reciting the structural or functional relationship therebetween. Where a claim is found to be a mere aggregation, courts have generally held that the claim does not particularly point out and distinctly claim the invention as required by 35 U.S.C. §112, second paragraph. Young v. United States, 179 USPQ 801, 808 (Ct. Cl. Trial Div. 1973), adopted, 204 Ct. Cl. 867, cert. denied, 419 U.S. 1002 (1974). In this case, even though the ground control is not claimed, the structural and functional relationship between the means for providing an indication of the body position and the fluid expulsion means is clearly set forth in each of the claims. Thus, these claims are clearly not mere aggregations of elements, but rather they each define a cohesive cooperative combination working together to perform the desired function.

35 U.S.C. §103

Defendant argues, in view of the prior art, that the subject matter of the Williams invention as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art and that therefore, in accordance with 35 U.S.C. §103,[10] the

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[10] 35 U.S.C. §103 provides:

"A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of

Williams patent is invalid. Defendant has proposed a number of combinations of prior art references. Each combination is claimed to show that the Williams invention would have been obvious. Plaintiff predictably argues that these combinations do not make the invention obvious. For the reasons discussed below, I have found that the invention claimed in each of the three claims of the Williams patent is not obvious.

The Supreme Court, in the case of Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 59, 466-67 (1966), set forth the following guidelines to be used in determining obviousness:

> Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

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this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter petains. Patentability shall not be negatived by the manner in which the invention was made."

Scope and Content of the Prior Art

Although numerous prior art references were introduced into evidence, Dr. William B. McLean's work is the most pertinent. This work is disclosed in U.S. Patent No. 3,216,674, filed June 8, 1959, and issued November 9, 1965. Both sides agree that the McLean patent is prior art to the CIP Williams patent. The McLean patent '674 was first cited in the prosecution of the Williams case in the January 10, 1966, office action. Soon thereafter, plaintiff decided to obtain an exclusive license under the patent. On May 15, 1967, an application for reissue of the original McLean patent '674 was filed in order to broaden the disclosure and claims. This application matured into reissue patent, Re. 26,887, on May 19, 1970. The parties, moreover, do not agree that the McLean reissue patent is a prior art reference with regard to the Williams patent, which was originally filed on April 18, 1960. As the disclosures of both the original patent and the reissue are nearly identical, the original patent will be discussed first.

The McLean device is closely related to the so-called "smart" missile technology developed during the 1950's, and in particular to the Navy's Sidewinder missile, with which Dr. McLean was intimately involved.[11] The Sidewinder missile is intended to automatically track, follow, and destroy moving targets (especially planes) within the earth's atmosphere. It is contemplated that the target will attempt evasive maneuvers, but that the missile will constantly monitor these movements and make the necessary changes in course to ensure

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[11] Dr. McLean was a member of the project staff for the Sidewinder missile.

collision. The tracking device, positioned in the head of the missile, is a gyroscope having a Cassegrainian telescope[12] located such that its optical axis is aligned with the axis of rotation of the gyroscope. An infrared detector is positioned in the focal plane of the telescope. Once the missile gets an infrared ray emitting target (for example, the engines of a jet plane) within the sight of the telescope, the tracker follows it, attempting to keep the target in the center of the telescope's field of view. This information is interpreted within the missile and relayed to the control fins so that the missile is kept on a collision course in accordance with the principles of proportional navigation.[13]

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[12] A Cassegrainian telescope is a form of reflecting telescope in which the rays are reflected from a primary mirror to a smaller secondary mirror and then through an opening in the primary mirror to the eye of the observer.

[13] A brief discussion of the principles of proportional navigation follows.

The object of proportional navigation is to set a collision course for a missile with a moving target. First, it is important to realize that a finite amount of time will elapse between the time the missile is launched and the time of collision with the target. During this time, the target will have changed positions. In order to account for this, the launcher must anticipate where the target will be when the missile finally gets in the area of the target. It turns out that a missile is on a collision course with a target when the range between the missile and the target is closing and the angle between the path of movement of the missile (the course line) and the line connecting the moving target and the missile (the sight line) remains constant. An example of this concept is shown in Fig. 16 of McLean which is reproduced below.

[Image Deleted in Printing]

The U.S. patent to Guthrie, et al., No. 3,010,677, which was filed on November 12, 1957, and issued on November 28, 1961, is a good example of the Sidewinder-type seeker system. Figure 2 of Guthrie, et al., reprinted below, shows the transparent front end 24 of the missile and the rotating gyroscope 16. The Cassegrainian telescope (see mirrors 16 and 17) is mounted as a part of the gyro

[Image Deleted in Printing]

and is used to monitor the position of the infrared ray emitting target so that the angle between the path of movement of the missile (the course line) and the line connecting the moving target and the missile (the sight line) can be determined. The axis of the telescope points along the sight line at the target and as a result the spin axis of the gyro (which is coincident with the optical axis of the telescope) is seldom positioned in line with the course line of the missile. When a change in the target position is detected, the gyro 16 is precessed[14] magnetically (using coils 27) so that the spin axis of the gyro is maintained in alignment with the

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Element 10 in the figure is the missile. The figure shows the relative position of the target and missile at four equally spaced instants of time.

Guiding a missile under the principles of proportional navigation involves (1) maintaining a closing range between missile and target and (2) maintaining the angle between the course line and sight line constant. Although this is not a complete explanation, for the purposes of this case, all that need be kept in mind is that when a change in the angle between the course line and sight line is detected, the missile direction must be changed in an amount proportional to the rate of change of the angle in order to maintain a collision course with the target.

[14] See n. 3, supra.

target. This information is then relayed to the adjustable control surfaces which act to change the course of the missile as needed. In the particular missile described in Guthrie, the control surfaces are retractable wings.

Applying the principles he was aware of from the Sidewinder project, Dr. McLean came up with a target-seeking vehicle useful for applications in outer space. Realizing that aerodynamic forces are not a factor in the vacuum of space, he decided that the entire vehicle could be set spinning and used as the gyroscope needed to determine the angle between the course line of the vehicle and the sight line from the vehicle to the target. McLean's vehicle is shown in Fig. 1 of the patent, which is reproduced below.

[Image Deleted in Printing]

As can be seen, the Cassegrainian telescope (see mirrors 18 and 19) is mounted on a spinning frame with the detector 12 positioned at the observation point of the telescope. The detector provides the information about the position of the target with respect to the spin axis of the vehicle (which is coincident with the telescope axis) that is needed to maintain the vehicle on a collision course with the target. In the Sidewinder missile, this information is used to precess the gyro into alignment with the target and to change the course of the missile. In the vehicle of McLean, the information is used to precess the entire space vehicle into alignment with the target and to change the course of the vehicle. However, the means used to provide these functions in the Sidewinder missile (electromagnets and adjustable control surfaces) would simply not work for McLean's space vehicle.

Dr. McLean knew from basic gyroscope dynamics that in order to precess his spinning space vehicle he needed to provide a torque about an exis perpendicular to the spin axis of the vehicle. In order to provide this torque, Dr. McLean positioned a precessing jet 16 near the edge of the vehicle, spaced from the spin axis and aligned such that the thrust force of the jet is along a line parallel to the spin axis. The portion of the spin cycle during which the jet is pulsed determines the direction of the precession.

The precessing jet changes only the orientation of the spin axis of the vehicle. In order to change the course, McLean provides a lateral jet 32 pointing outwardly from the edge of the vehicle such that the thrust of the jet is directed through the center of mass of the vehicle. The portion of the spin cycle during which the lateral jet is pulsed determines the course correction. McLean assumes that a forward velocity is imparted to the vehicle when it is launched into outer space so that no additional forward thrust is needed. (See col. 6, lines 65-68, of McLean.)

[Image Deleted in Printing]

Figure 3 of McLean is reprinted here as an aid in explaining how the detector system works. Reticle 20 is placed in the focal plane of the telescope with an infrared detector 22 positioned directly behind it. The reticle is a thin circular element divided into two halves with a line through the middle. One- half is transparent, and the other is opaque. When the telescope gets the infrared ray emitting target within its field of view, the image appears at the reticle. If the target is aligned with the telescope axis, then, as the vehicle and the reticle spin, the photodetector 22 detects only a

constant amount of infrared radiation because the image of the target is in the center of reticle.

If the target, due for example to relative acceleration, should move away from alignment with the axis of the telescope, the image of the target will be blocked from the detector 22 during half of the spin cycle and permitted to pass during the other half. T his results in an alternating signal being provided by the detector 22.

As will be seen later, when the differences between Williams' claimed invention and the structure of McLean are compared, it is important to ascertain exactly how much information this alternating signal provides. In this connection, it may be useful to consider the line dividing the reticle 20 into opaque and clear halves together with the spin axis (or telescope axis) as forming an imaginary plane spinning at the same rate as the space vehicle. When the current from the detector 22 goes from low to high, the imaginary plane has swept past the target and the image of the target has gone from the opaque portion of the reticle to the clear part. This provides enough information to determine when during the spin cycle the precessing jet needs to be fired in order to precess the spin axis towards alignment with the target. The detector 22 is connected through an amplifier to the precession jet so that every time the signal goes from low to high, the jet is activated. By positioning the jet properly with respect to the reticle, the jet is activated during the correct portion of the spin cycle to provide the desired precession (toward the target). Additionally, in order to make adjustments without the need to physically change the position of the reticle, a phase-shifting circuit is provided. The signal that activates the preces-

sion jet simultaneously activates the lateral jet in order to maintain the spinning vehicle on a collision course.

In a preferred embodiment of the reticle, McLean provides alternately opaque and clear segments in the clear half of the reticle. Because the segments are shaped like pie slices, a target that is close to alignment and provides an image close to the center of the reticle will be partially obscured by the edges of the segments at all times. When the image of the target is further from the center, more of it will be exposed to the detector. The resulting differences in current are proportional to the angle between the spin axis and the line of sight to the target. These differences in current are applied through an amplifier to vary the thrust from the jets—a higher thrust being applied where the angle is greater.

Because the vehicle of McLean is a target seeker, it would be desirable to eliminate as many extraneous signals as possible. Although the disclosure appears not to address this issue, it is clear that the field of view of the telescope must be fairly narrow. One of defendant's witnesses at trial suggested that the field of view is of the order of 8 to 10 degrees.

Although the McLean space vehicle was developed in the context of seek-and- destroy type missiles, there appears to be no discussion of any particular use apart from general navigation towards a target. The disclosure at col. 2, lines 63-64, of McLean suggests that the target could be the moon, a planet, or some other space vehicle.

The McLean Reissue

As mentioned previously, the plaintiff, soon after becoming aware of the original McLean patent (U.S.

Patent No. 3,216,674) acquired an exclusive license under it. Plaintiff filed for a reissue patent on May 15, 1967, which application matured into reissue patent Re. 26,887 on May 19, 1970. The issue here is whether this patent is prior art to the original Williams patent, which was filed April 18, 1960.

However, there is no need to decide this issue, because the disclosure of the McLean reissue adds nothing of significance to what was disclosed in the original McLean patent. The only possible argument that something of substance has been added appears to be that the broader introductory statements made in the reissue indicate that uses other than proportional navigation was contemplated. Even if accepted as true, this inference would not aid defendant in establishing obviousness. The only embodiment disclosed in the reissue is the one disclosed in the original application. There is no suggestion of what, if any, the other uses might be. A broad suggestion that other uses may be found does not aid one of ordinary skill in the art to determine what those uses are. Thus, there is no need to decide whether the reissue is prior art to the Williams patent because the reissue adds nothing to the original disclosure. All further references to "McLean" are intended to be to the original McLean patent (No. 3,216,674).

Additionally, in connection with the McLean reissue patent, defendant makes an argument that is applicable to both the obviousness issue and the inequitable conduct issue. Defendant, in particular, argues that the McLean reissue is relevant because the claims in the reissue patent cover "and therefore describe" spin-stabilized satellites like the one disclosed in Williams. (See pp. 105-06 of defendant's posttrial brief,

part II, vol. 1.) If the mere fact that a claim in the McLean reissue patent covers the satellite structure disclosed in Williams meant that the McLean reissue patent described the Williams satellite, then the issue of whether or not the McLean reissue is prior art would have to be decided. However, it is basic in patent law that a claim in a patent can cover or dominate a later invention without fully describing the later invention. Deitel v. La Minuette Trading Co., 37 F.2d 41, 4 USPQ 92 (2d Cir. 1930). For example, a patent with a claim to a television set would cover and dominate a later invention to the combination of the same television set, plus a remote control. There is no need to describe the remote control in the disclosure of the earlier patent. There is no description of spin-stabilized satellites in the McLean reissue, and the fact that the claims may cover such satellites does not magically provide any absent disclosure. The issue under 35 U.S.C. §103 is whether the later invention is obvious in view of the disclosure of the prior art patents, not whether the claims of the prior art patents read on the later invention.

Other Prior Art

Two other prior art references are of interest and will be briefly discussed. The U.S. patent to Null, et al., Patent No. 2,955,777, filed August 19, 1946, and issued October 11, 1960, shows an automatic target-seeking missile for use within the earth's atmosphere. Radiation emitted from the target is detected in the front end of the missile and used to make course corrections automatically where necessary. The interesting fact for the purposes of this case is that Null, et al., suggests that in order to prevent the missile from accidentally acquiring the heat emitting engines of the mother plane as a

target, a remote control system should be provided at the launching station (the mother plane in Null, et al.) which is capable of overriding the automatic controls.

The other patent, No. 3,396,920, filed December 30, 1959, issued on August 13, 1968, to Harold A. Rosen and Donald D. Williams. Donald D. Williams is, of course, the sole inventor of the patent in suit. The '920 patent was discussed previously and discloses a spin-stabilized satellite for use especially in an orbit synchronized with the spin of the earth. Rosen, et al., uses a directional antenna aligned with the spin axis and solves the orientation problem by stopping the spin, changing the position of the satellite, and then starting the spin up again. All of this is done by remote control from the ground.

The Differences Between the Claims of Williams and the Prior Art

Defendant's basic argument is that the McLean device includes all the elements of the claims of Williams except for the remote control aspect, and that provisions for remote control would have been an obvious addition to the device of McLean. This argument fails because, as explained below, the device of McLean does not include all of the elements of the claims of Williams, except for the remote control.

The element of claim 1 that gives defendant the most trouble in this regard is (e). There is no need to discuss the other two claims separately because they contain substantially the same subject matter with differences that are not materia! to the issues involved here. Element (e) of claim 1 reads:

e. means disposed on said body for providing an indication to a location external to said body of

> the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system; * * *.

At trial, when the defendant's expert witness, Mr. Wilhelm, was asked to compare this language with the device of McLean, he said: "Well, that one starts to give me a little trouble." Mr. Wilhelm went on to indicate that the McLean telescope sensor does not fit the classical definition of indicating the spacecraft's instantaneous spin angle position and spin axis orientation with reference to a fixed coordinate system. He also hastened to add that while McLean did not provide the claimed indications, neither did Williams. Prior to the court's earlier decision in this case, defendant's position on this point was that:

> [T]o the extent * * * the Williams apparatus can be considered to determine [the claimed] relationship, McLean does the equivalent and there is no difference between these two systems.

This court, in the decision of December 17, 1980 (Hughes Aircraft Co. v. United States, 226 Ct. Cl. ——. 640 F.2d 1193, 208 USPQ 785 (1980)), adopted most of the findings of fact made at the trial level. *Id.* at ——, 640 F.2d at 1193, 208 USPQ at 786. These findings are now established facts of the case. Findings 33-61 show that the disclosure supports the recitations of the claims, and particularly the means for providing the indication to the earth station required by section (e) of claim 1.

Defendant's former argument that both McLean and Williams are equally deficient is no longer valid. Defendant must show that McLean meets every element

of the claim except for the remote control in order to support its obviousness argument. On this issue, defendant has the burden of proof. *Aluminum Co. of* America v. Amerola Products Corp., 552 F.2d 1020, 1024, 194 USPQ 1, 4 (3rd Cir., 1977); Laser Alignment, Inc. v. Woodruff & Sons, Inc., 491 F.2d 866, 871, 180 USPQ 609, 611 (7th Cir., 1974), cert. denied, 419 U.S. 874, 183 USPQ 321 (1974). The defendant has failed to meet this burden. In order to understand why, it is necessary to understand the technical requirements of the Williams claims and the functioning of the McLean target-seeking space vehicle.

The best place to start is to look at what it is that element (e) of claim 1 of Williams requires. Element (e) calls for means providing an indication of the instananeous spin angle position (ISA) of the spinning body with reference to a fixed external coordinate system. A fixed external coordinate system is one fixed with respect to the distant stars. The instantaneous spin angle position (ISA) with reference to a fixed external coordinate system is more difficult to define. In order to precess the body in a predetermined direction, it is necessary that the angle between the line connecting the precessing jet with the center of mass of the body and the plane formed by the line connecting a known reference point in an external coordinate system (e.g., the sun or a star) with the center of the body and the spin axis be known for any given instant of time. This angle, when given for a particular instant of time, is the instantaneous spin angle position with reference to a fixed external coordinate system. The minimum amount of information needed to determine the ISA with respect to a fixed external coordinate system is (1) the spin rate of the body, and (2) the instant in time at

which the plane formed by the spin axis of the body and the line connecting the precessing jet with the center of mass of the body sweeps past a known fixed point (e.g., the sun or a star) in a fixed external coordinate system.[15]

Additionally, element (e) requires means for indicating the orientation of the spin axis of the body with reference to a fixed external coordinate system. The meaning of this requirement is apparent on its face.

Element (e) of claim 1 requires that there be an indication provided of both the ISA and the spin axis orientation. Elements (f) and (g) go on to explain that this information is to be used to generate synchronized signals to control the pulsing of the axial jet:

> [F]or precessing said body to orient said [spin] axis in a predetermined desired relationship with said fixed external coordinate system.

In order to perform the claimed function, it is necessary that both the indication of the ISA and the indication of the spin axis orientation be provided at the remote location at the same time.[16] This is because in order to precess the body into a desired orientation within a fixed external coordinate system, the initial orientation must be known, and in order to pulse the jet in the proper portion of spin cycle to provide the torque needed for the desired precession, the angular position

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[15] The direction of spin must also be known, but for all spacecraft considered in this opinion the direction of spin is assumed to be known because the spin is intentionally induced.

[16] This does not mean that the information from which the ISA and orientation is determined must be transmitted at the same time. It only means that both the ISA and orientation must be known on the ground at the same time.

of the axial jet must be known. Thus, claim 1 requires that the indication of the ISA and the indication of the spin axis orientation be provided at the same time, since otherwise the device would not be capable of performing the claimed function.

The space vehicle of McLean is designed to maintain a collision course with a target. The Williams satellite is designed to maintain its spin axis in an orientation parallel to the earth's spin axis while in synchronous orbit around the earth. Although both devices use an axial jet pulsed synchronously with the spin cycle for changes in orientation, the differences in function lead to important structural differences in the two devices. Because the space vehicle of McLean is designed to maintain its spin axis pointed at an infrared emitting target, the sensor is directed along the spin axis. In order to reduce the possibility of confusion with other infrared emitting objects, the field of view of the telescope which focuses the image of the target on the sensor is fairly narrow (of the order of 8 to 10 degrees).

The satellite of Williams uses the sun as its reference point in a fixed external coordinate system to determine the ISA and to help determine the orientation of the spin axis. In Williams, it is desirable to sense the sun in as wide a range of satellite orientations as possible while maintaining a lightweight design. Thus, the sensor in Williams consists of two slits (one parallel to the spin axis and one at an angle) in the outer skin of the satellite, each one having a sensor mounted behind it so that as the slits in the satellite spin past the sun the sensors are illuminated. The optical field of view using this setup is about 140 degrees centered about a line perpendicular to the spin axis. The fact that the sun emits such a large amount of radiation makes the

chance of confusing the sun signal with other lower level radiation emitting objects negligible.

The time lapse—between the determination that a course change is necessary and the implementation of the course change—is critical in the context of target seeking, particularly where the target is moving. Because of this, the space vehicle of McLean is wired to provide both course correction and orientation correction at the same time that the sensor discovers that such corrections are needed. In Williams, the time lapse is not as critical. Once the satellite of Williams is placed in synchronous orbit around the earth, the orientation needs to be changed so as to align the spin axis of the satellite with the earth as soon as possible. This orientation provides optimal antenna reception. There is no need, however, to change the orientation immediately. As a result, the satellite is wired so that no orientation correction is made until the ground controller decides that it is time to make a correction.

Despite these differences in structure and operation, defendant argues that the McLean space vehicle provides the information required by claim 1. To arrive at this conclusion, defendant takes me down a fairly rocky logical road. Initially, for purposes of this opinion, I have been asked to assume and will assume, as defendant has, that the position of the center of the McLean vehicle would be known for any given instant of time through the use of range tracking, and that the McLean target can be a star.

As I begin my analysis, it is important to recall that the space vehicle of McLean can be treated as having two modes. The quiet mode is when the spin axis of the vehicle is directly aligned with the target. Only a steady signal is produced by the sensor. The alter-

nating mode occurs when the spin axis is out of alignment with the star. During this mode, an alternating signal is produced as the target image falls on the dark and then the clear parts of the reticle.

When the sensor emits a steady state signal, the orientation of the spin axis in a fixed external coordinate system can be determined. This is because the position of the satellite with respect to the earth is known through range-tracking techniques, and the signal indicates that the spin axis is pointing directly at a known star. However, there is no indication of the instantaneous spin angle position, because the sensor is providing only a steady state signal. When the sensor signal is alternating, the instantaneous spin angle position with reference to a fixed external coordinate system can be determined.[17]

In the case of McLean, it is best to view the rotating imaginary plane as being defined by the spin axis and the line between the opaque and the clear portions of the reticle. The position of the axial jet with respect to this plane is known. Thus, after the second time this plane sweeps past the star as indicated by the signals generated by the sensor, the angular velocity (i.e., the spin rate) of the vehicle can be determined.[18] The time at which the plane sweeps past the target star (which is

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[17] To make this determination, defendant assumes that it would take at least two successive pulses from the precession jet before the spin axis is aligned with the star. As plaintiff has made no objection to this assumption, and since it appears likely that at least in some cases two or more successive pulses would be needed, I accept defendant's assumption.

[18] This result is not affected by the fact that between signals the orientation of the vehicle has changed. This is because the precession is in a direction towards the target star.

fixed in an external coordinate system) is determined by observing when the sensor changes from a low signal to a high signal. In accordance with the definition discussed earlier, this is enough information to determine the instantaneous spin angle position.

The orientation of the spin axis, however, cannot be determined without ambiguity while the McLean device is in the alternating signal mode. The position of the target star in a fixed external coordinate system is known. The angle (let us call it the "star angle") between the line connecting the star to the center of the vehicle and the spin axis of the vehicle is known because of the relative intensity of the sensor signal. The position of the vehicle is known through the use of range-tracking techniques. However, this information still does not define the orientation of the spin axis of the vehicle with respect to a fixed external coordinate system. The spin axis may lie anywhere within a "cone of ambiguity." This may be illustrated with the aid of a pair of scissors. Call the long blade the line between the star and the center of the vehicle and the short blade the spin axis. The angle between the blades is the star angle. The scissors may be rotated about the long blade, so that the short blade assumes a variety of orientations without changing the angle between the blades. As the scissors are rotated, the short blade describes what a mathematician would call a cone of revolution, and what in this case is referred to as a cone of ambiguity.

Of course, for the purposes of McLean, there is no need to resolve this ambiguity. All McLean needs to know to process towards the target is the relative position of the spin axis and the axial precession jet with respect to the target. In Williams, however, the

ambiguity must be resolved in order to permit changes in orientation to a predetermined orientation *within a fixed external coordinate system.* It is the means for providing this additional information in combination with the remote control which was stressed as the major distinguishing feature in arguments made by the plaintiff before the examiner during the prosecution of the Williams application.

Defendant, however, points out that the disclosed embodiment of Williams, like McLean, only provides an indication of the angle between the line from the sun to the center of the satellite and the spin axis. Thus, just as in McLean, more information is needed in the disclosed embodiment of Williams to resolve the ambiguity. Unlike the situation with McLean, however, findings of fact 33- 61 made at the trial level and adopted by the court show that the disclosure in the Williams patent is sufficient to support the language of the claims. The claims require an unambiguous indication of the orientation of the spin axis in a fixed external coordinate system. In discussing the cone of ambiguity problem of the Williams satellite, the court found:

> 45. The existence of these ambiguities and the techniques for overcoming them would have been obvious to any person of ordinary skill in the art of celestial navigation.
>
> 46. Such a person would know that these ambiguities could be resolved in at least two different ways: by dead reckoning; or by adding an earth sensor. The disclosed embodiment does teach the use of an antenna with an asymmetric radiation pattern as a crude earth sensor.

Hughes Aircraft Co., 640 F.2d at 1215, 208 USPQ at 805.

Defendant boldly points to these findings and claims that the McLean cone of ambiguity "is of no patentable significance" because it can be overcome in any of the ways suggested in the findings. However, these findings deal exclusively with the Williams satellite. There is no suggestion from the findings that they would be applicable to the target-seeking space vehicle of McLean. Furthermore, it appears likely that these findings would not apply to McLean due to the functional and related structural differences between the McLean and the Williams devices.[19] Finally, even if the techniques suggested in the findings could be used in McLean, there is no reason to do so because McLean does not need the extra information.

Defendant has the burden of proof on this issue. However, defendant fails to direct the court to any evidence in the record showing that the McLean device provides the claimed indication. Instead, the court is

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[19] Where dead reckoning is selected as the means for providing the extra information, it might be argued that the only difference between McLean and Williams relates to intended use. This, however, would not be accurate. Because of the differences in structure, including selective remote control of the jet pulses from the ground instead of automatic course correction pulses and the different sensor setups, the device of Williams is physically adapted to take advantage of the dead- reckoning procedures suggested by the findings. It is not at all clear that these same procedures would work in the case of the McLean vehicle. Indeed, there has been no testimony to that effect. The physical differences in the Williams satellite which permit the dead-reckoning procedures to work are part of the claimed means for providing an unambiguous determination of the orientation of the spin axis in a fixed external coordinate system.

asked to infer that McLean provides an unambiguous indication of the orientation of the spin axis during the alternating signal mode (i.e., where the spin axis is out of alignment with the target star) from findings that one of ordinary skill in the art would recognize the ambiguity problem in Williams and know how to solve it.

As should be obvious by now, the issues are different. The court's previous findings were directed at establishing whether or not the language of the claims of the Williams patent was supported. This court found that it was, because unambiguous knowledge of the orientation of the spin axis in an external coordinate system is necessary to the operation of the Williams device and the means for providing this information was well known in the art. In defendant's argument, the issue is whether the McLean vehicle, which does not need the extra information, nevertheless provides means for resolving the cone of ambiguity associated with its indication of the orientation of the spin axis during the alternating signal mode. Not only are there no findings directed specifically to this issue, but defendant's own witness, Mr. Wilhelm, indicated that the information provided by McLean does not fit the classical definition of indicating the spacecraft's instantaneous spin angle position and spin axis orientation with reference to a fixed coordinate system.

As defendant relies solely on these findings, defendant has failed to satisfy its burden of proof on this issue.

In sum, during the alternating signal mode, where the spin axis of McLean is out of alignment with the target star, McLean provides an indication of the in-

stantaneous spin angle position, but not the orientation of the spin axis within a fixed external coordinate system. During the quiet mode, where the spin axis is aligned with the target star, McLean provides an indication of the orientation of the spin axis, but not the instantaneous spin angle position, within a fixed external coordinate system. As previously discussed, the claims require that the ISA and orientation be indicated at the same time in order to permit controlled precession in a fixed external coordinate system. It follows then that defendant's basic obviousness argument that McLean has every element called for in the claims except the remote control must fail.

In the above analysis, the differences in function between the McLean and Williams devices which are reflected in structural differences has been stressed. Additionally, as discussed above, these differences are reflected in the claim language. Specifically, wherein Williams calls for an indication of the orientation of the spin axis within a fixed external coordinate system, McLean does not. Defendant argues that the distinction between the functions of the two devices should not be given much weight, however, because the specification of the Williams patent indicates that the concept of Williams could be used in constructing a target-seeking vehicle in accordance with proportional navigation principles. The problem with this argument is that the claims in issue were narrowed by amendment in response to the examiner's citation of the McLean reference many years after the original application was filed. Although the claims of Williams do not specifically exclude coverage of all target-seeking vehicles, they call for means which the McLean vehicle does not have. Thus, to the extent that target

seekers do not include the claimed elements, the claims of Williams do not cover them.

Level of Ordinary Skill in the Art

Although failure of the defendant's basic obviousness argument disposes of most of the 35 U.S.C. § 103 issues, two minor arguments should be discussed. After a careful review of the record, I have determined that the level of ordinary skill in this art was that of an aerospace engineer practicing in 1960 with some exposure to the problems of synchronous orbit telecommunication satellites. In accordance with 35 U.S.C. §103, the question is whether defendant's proposed changes to McLean would have been obvious to such a person.

In order to show that the teaching of McLean could have been modified to accomplish the same result as Williams, defendant argues that it would have been obvious to close the lateral course correction jet of McLean. Next, the defendant apparently argues that it would have been obvious to mount the McLean sensor on the side of the McLean space vehicle. If these changes were in fact obvious, the McLean space vehicle would begin to look structurally much more like the satellite of Williams. However, in order to be obvious, such changes must somehow be suggested in the art.

In any consideration of obviousness, it is alwalys [*sic*] necessary to be vigilant against the possibility of hindsight creeping into the analysis. One way that the courts have guarded against hindsight is by insisting that the reason for making the suggested changes be apparent at the time the invention was made to a person of ordinary skill in the art. *In re Nomiya, Kohisa and Matsumura*, 509 F.2d 566, 184 USPQ 607 (CCPA 1975). Here, there is simply no suggestion in

the art to make these changes and thus they would not have been obvious. Furthermore, it is generally settled that a change in a prior art device which makes the device inoperable for its intended purpose cannot be considered to be an obvious change. *Block v. Nathan Anklet Support Co.*, 9 F.2d 311, 312 (2d Cir., 1925); *Diamond International Corp. v. Walterhoefer*, 289 F.Supp. 550, 559, 159 USPQ 452, 460-61 (D. Md., 1968); *L.E. Sauer Machine Co. v. Corrugated Finishing Products, Inc.*, 642 F.2d 203, 210 USPQ 81 (7th Cir., 1981). In the case at bar, it is clear that if the McLean space vehicle were modified as suggested it would no longer be capable of performing its intended target-seeking function. Thus, the suggested changes are not obvious changes.

Inequitable Conduct

In over 130 pages directed to the issue of inequitable conduct, defendant in its brief makes only two points that are considered worthy of some discussion. First, defendant claims that the plaintiff made statements to the examiner about the McLean reference which were untrue and inconsistent with statements made when obtaining the McLean reissue. Second, defendant claims that the plaintiff should have, but did not, cite the McLean reissue to the examiner, the Board of Appeals and the CCPA as relevant prior art. Defendant argues that this conduct amounts to unclean hands in the prosecution of the patent application and should result in the patent being held unenforceable.

However, as will be explained below, the acts or omissions cited by defendant did not amount to unclean hands.

None of the numerous statements made by the plaintiff and quoted by the defendant can be considered to be either untrue or inconsistent. The statements in question were made in plaintiff's April 29, 1966, response to the examiner's January 10, 1966, rejection. In this rejection the examiner, for the first time, cited the McLean patent (No. 3,216,674). Both the examiner and the plaintiff immediately recognized the relevance of McLean. They both saw that although McLean was not designed for earth orbit, it clearly disclosed the basic synchronously pulsed jet precession concept which plaintiff had broadly claimed. As a result, plaintiff in its April 29, 1966, response severely contracted the scope of its claim coverage to avoid the McLean reference.

The newly submitted claims were accompanied by about 11 pages of remarks which explained the plaintiff's interpretation of the cited references (including McLean) and the plaintiff's explanation of how it thought the new claims avoided these references. A few examples of the quoted comments will suffice to capture the flavor of the remarks. Plaintiff argued in the response that:

McLean's infrared telescope does not indicate the instantaneous spin angle position of his body *with reference to a fixed external coordinate system, and it does not indicate the orientation of the axis with reference to a fixed external coordinate system.* * * * No fixed external coordinate system is involved [in McLean].

* * *

McLean's device would be incapable of performing the function of applicant's claimed invention; namely

re-orienting the spin axis to point in a desired direction while in orbit. It is only capable of pointing the spin axis at a target.

* * *

There is no thought [in McLean] of orienting the spin axis of a satellite in orbit. [Emphasis in original.]

Although some of these statements may be argumentative, each is supportable by reference to the McLean disclosure. In fact, the view that I have taken of the McLean patent after a careful review of the record is quite similar to that expressed by plaintiff many years before this litigation began.

The first statement listed above has two parts—one dealing with ISA, and one with orientation. It is clear from my consideration of the obviousness issue, that McLean never indicates both the ISA (instantaneous spin angle position) and the orientation at the same time as required by the claims of Williams. Instead, only one of these is literally present for each of the two modes of McLean. In the alternating mode, only the ISA is known; and in the quiet mode (with the axis pointed at the target star), only the orientation is known. It should, moreover, be remembered that defendant made a number of assumptions in order to even be able to make its rather feeble case on obviousness. For example, it was assumed that the target was a star. However, it is certainly arguable that the target could not be a star, as McLean makes no mention of stars as targets in the specification. If the target were not a star, then it is not at all clear that McLean would ever indicate either the ISA or the orientation with respect to a fixed coordinate system. This is because McLean

does not need this information to perform its desired function.

The second statement is also correct. On the one hand, since the McLean vehicle automatically precesses towards the target, no fixed external coordinate system is needed. On the other hand, since the Williams satellite is capable of reorienting itself from one known position to another within the external coordinate system, a fixed external coordinate system is quite necessary. This reorientation is made possible in Williams by providing more complete information about the ISA and orientation in combination with means for permitting ground control of the satellite. There can be no question that the examiner understood what the plaintiff was saying. The examiner had the McLean reference in front of him at all times and could immediately compare all of plaintiff's statements with the McLean disclosure.

The third statement quoted above is patently true from a reading of the McLean patent. There is simply no discussion of use of the McLean device in orbit, or, for that matter, of reorienting the spin axis of the McLean device while it is orbiting the earth.

Furthermore, even if these statements could somehow be interpreted as being misleading or untrue, it is far from clear that such conduct should make an otherwise enforceable patent unenforceable. If the plaintiff makes a mistake in interpretation, it is the examiner's duty to recognize this and act accordingly. No examiner worth his salt would thoughtlessly accept the word of an applicant as to the relevance of a cited reference without verifying it.

Defendant cites some cases in support of its argument that plaintiff's representations regarding the

McLean reference make out a case of inequitable conduct, but in each case the conduct has involved the omission or misrepresentation by the applicant of facts which cannot be independently discovered or confirmed by the examiner. Those cases are inapposite in situations such as the one at bar where the examiner has the reference being discussed right in front of him.

Defendant also contends that inconsistent statements made by the plaintiff regarding the McLean patent in connection with its April 1966 response in Williams and during the prosecution of the McLean reissue patent amounts to inequitable conduct. As the McLean reissue was filed on behalf of the plaintiff, it is fair to consider statements made during its prosecution as attributable to the plaintiff. A comparison of a representative pair of statements will show that defendant's argument is without merit.

In the remarks of the April 1966 response, plaintiff states:

> McLean * * * is [not] concerned with orienting the spin axis of a satellite in orbit by precession. * * * [McLean does not disclose] apparatus which could produce such a mode of operation or result.

In the reissue declaration, the plaintiff, through the inventor, William B. McLean, said:

> [T]hat he claimed less than he could rightfully have claimed in the patent in that all the claims therein were inadvertently limited to specific applications of the invention to the field of self-contained proportional navigation apparatus for following a collision course to a target body, whereas the invention is not so limited, but has utility generally where control of

> the velocity and attitude of a spinning body is desired as in artificial satellites of the earth; * * *.

Defendant merely points to these statements and claims that the inconsistency is apparent. However, it is not apparent to me, and in fact it is clear that these statements are fully consistent. In each case the issues are different. In the case of the April 1966 response, the question is whether the invention claimed by Williams is disclosed by McLean. As discussed previously, it is not, and that is what plaintiff is pointing out. Although McLean has some of the apparatus (i.e., the pulsed precession jet) needed to perform the function of orienting the spin axis of a satellite in orbit by precession in accordance with the teaching of Williams, it clearly does not have all the apparatus disclosed by Williams to produce such a mode of operation.

In the case of the reissue declaration, the question is whether or not through inadvertent error the original patent is partly inoperative to protect McLean's invention by reason of the fact that it claims less than he had a right to claim in the patent, 35 U.S.C. § 251. In order to show this, plaintiff points out what would be obvious to anyone who understands both McLean and Williams. That is, that the pulsed precession jet concept used to precess the McLean vehicle could be used to precess and thus change the orientation of any spinning space body, but that the original claims of McLean were limited to the target-seeking application.

It is, of course, hornbook patent law that the disclosure of a specie entitles the inventor to claim not only the disclosed specie, but also the genus. Thus, McLean would not only be entitled to claim the disclosed target-seeking structure, but he would also be entitled to broadly claim the precession jet structure.

Thus, the fact that a protion of the McLean system (the precession jet) could be generally claimed for precessing a satellite does not mean that McLean discloses the use of its pulsed precession jet concept with a satellite. In fact, McLean does not. Defendant's contention that plaintiff's statements are inconsistent must, therefore, be rejected.

Finally, defendant argues that the McLean reissue patent is prior art to Williams and should have been cited to the examiner, the Board of Appeals and the CCPA. The question of whether the McLean reissue is prior art has previously been considered in the 35 U.S.C. §103 portion of this opinion. There was no need to decide the question there because the broadened disclosure of the McLean reissue was found to add nothing of significance to the original McLean disclosure. Here, as will be shown below, there is also no need to decide whether the McLean reissue is prior art because, even if it is prior art, plaintiff's conduct did not amount to unclean hands.

The proceeding before the examiner in the Patent and Trademark Office is ex parte and the examiner has no power to investigate and check factual assertions made during the prosecution. For this reason, the applicant must be held to a high standard of candor and good faith. Precision Instrument Mfg. Co. v. Automotive Maintenance Mach. Co., 324 U.S. 806, 65 USPQ 133 (1945); Kingsland v. Dorsey, 338 U.S. 318, 83 USPQ 330 (1949); Corning Glass Works v. Anchor Hocking Glass Corp., 253 F. Supp. 461, 470, 149 USPQ 99, 107 (D. Del. 1966), *rev'd on other grounds*, 374 F.2d 473, 153 USPQ 1 (3rd Cir., 1967), *cert. denied*, 389 U.S. 826, 155 USPQ 767 (1967).

Indeed, §1.56(a) of Title 37 of the Code of Federal Regulations, which has the full force and effect of law, recognizes the disadvantage of the examiner and imposes the following duty on all applicants for patents:

> A duty of candor and good faith toward the Patent and Treadmark Office rests on the inventor, on each attorney or agent who prepares or prosecutes the application and on every other individual who is substantively involved in the preparation or prosecution of the application and who is associated within the inventor, with the assignee or with anyone to whom there is an obligation to assign the application. All such individuals have a duty to disclose to the Office information they are aware of which is material to the examination of the application. Such information is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent. The duty is commensurate with the degree of involvement in the preparation or prosecution of the application.

Where this standard has not been met, courts have found the applicant to have unclean hands and, in accordance with the principles of equity, have refused to enforce the patent. This standard is in harmony with the decisions of many courts that have dealt with this issue. See, for example, Corning Glass Works, *supra*; SCM Corp. v. Radio Corp. of America, 318 F. Supp. 433, 449, 167 USPQ 196, 207-08 (S.D. N.Y. 1970). As discussed previously, the disclosure of the McLean reissue adds nothing of significance to the disclosure of the original McLean patent. Although the examiner may have been interested in the McLean reissue, it is not a particularly relevant reference because the examiner

had already thoroughly considered the disclosure of the original McLean patent. The withholding of the McLean reissue can hardly be considered the type of conduct which would lead to a holding of unenforceability. Accordingly, defendant has failed to prove that plaintiff has indulged in any inequitable conduct, and its contentions must be rejected.

Infringement

Plaintiff alleges that the following spacecraft systems, which have been used or manufactured by or for the United States[20] after September 11, 1973 (the issue date of the Williams patent), infringe the claims of the Williams patent No. 3,758,051): Skynet II, NATO II, DSCS II, IMP (H and J), Solrad (9 and 10), and Pioneer (10 and 11). The defendant claims that none of the systems listed above infringe any of the claims of the Williams patent.

It is useful to divide these systems into two groups. The first group consists of Skynet II, NATO II, DSCS II, IMP (H and J), and the programmed mode of Pioneer (10 and 11). These systems will be referred to as "store and execute" (S/E) systems. The second group consists of Solrad (9 and 10) and the real time mode of Pioneer (10 and 11). These two systems will be referred to as "real time" systems. The reasons for these names will become apparent as the systems are described.

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[20] 28 U.S.C. §1498 reads in pertinent part: "Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the Court of Claims for the recovery of his reasonable and entire compensation for such use and manufacture."

I have determined for reasons detailed below that none of the S/E systems infringe any of the claims of the Williams patent, and that both of the real time systems infringe the Williams patent.

The Store and Execute Systems

The store and execute systems have many elements that are similar, if not identical, to the system described in the Williams patent. Each of the systems includes (1) a spin-stabilized spacecraft; (2) means for determining the orientation of the spin axis of the spacecraft from the earth; (3) means for signaling from the earth to the spacecraft that a change in orientation is desired; (4) a precession jet mounted on the spacecraft offset from the spin axis; and (5) means for pulsing the offset jet in synchronism with the spin of the spacecraft so that the spin axis is precessed in the desired direction. The Williams system includes all of these elements. However, it is basic in patent law that the claims, not the patent disclosure, define the scope of invention. 35 U.S.C. §112, second paragraph. No matter how fair or equitable it may seem, a court cannot rewrite the claims. Autogiro Co. of America v. United States, 181 Ct.Cl. 55, 60, 384 F.2d 391, 396, 155 USPQ 697, 701 (1967). As will be shown below, the claims of the Williams patent each call for at least two elements that cannot be found in any of the Skynet II, NATO II, and DSCS II systems, and at least one element that cannot be found in either the Solrad (9 and 10) system or the programmed made of the Pioneer (10 and 11) system. Additionally, it will be shown that the doctrine of equivalents does not operate to expand the scope of the claims to cover these systems. Thus, the store and execute systems do not infringe the claims of the Williams patent.

Claim 1 of the Williams patent reads in pertinent part as follows:

> e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;
>
> f. and means disposed on said body for receiving from said location control signals synchronized with said indication;
>
> g. said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for processing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

Claims 2 and 3 claim substantially the same subject matter a little more narrowly. Due to the fact that I find no infringement, there is no need to consider these differences in connection with the store and execute system.

The first step is to ascertain the meaning of the portion of claim 1 quoted above. As many cases have recognized, the written word is a valuable but imperfect conduit by which ideas may be conveyed. Id. at 61, 384 F.2d at 396, 155 USPQ at 702. In determining what concepts the plaintiff intended to convey when it wrote the claim language, I am guided by (1) the specification, (2) the drawings, and (3) the file wrapper.

The instantaneous spin angle position (ISA) with respect to a fixed coordinate system has been defined in my previous consideration of defendant's contention that the patent in suit was obvious. In order to understand what the ISA is, it is important to see what purpose this information serves. Application of the torque needed to precess the spinning spacecraft is provided by a jet offset from the spin axis. This jet is spinning with the spacecraft. In order to provide a torque in only one desired direction, the jet must be pulsed on for only a short time, i.e., for less than an entire revolution of the satellite, while it passes through the proper position. In order to pulse the jet at the desired time, the angle between the plane formed by the spin axis and a line from the jet to the center of the mass of the satellite (which plane is constantly rotating) and the reference plane formed by the spin axis and the sun vector (the line from the sun to the center of mass of the satellite) must be known for all instants of time. Thus, the instantaneous spin angle position in a fixed external coordinate system is a measure of where the precessing jet is in its cycle relative to a reference plane at any given instant of time. Because the spacecraft is always spinning, the ISA is a constantly changing value.

The claim requires only that an "indication" of the ISA be provided to an external location and not the ISA itself. The distinction between providing an "indication" of the ISA and providing the ISA itself is clear after gaining an understanding of the operation of the Williams system. In order to synchronize the precession jet commands sent from the earth controller with the spin of the Williams satellite, the ISA must be known on the ground. However, there is no need to

send a constant series of angles (the ISA for any given instant) directly from the satellite. All that is needed is to send enough information from the satellite such that the instantaneous spin angle position can be determined for any given instant of time. Plaintiff recognized this and, as a result, decided to use the broader language "indication of the instantaneous spin angle position."

This interpretation, that "indication" of the ISA means enough information from which the ISA can be determined, is consistent with the requirements of the rest of the claim. Clauses (e), (f) and (g) of claim 1 require that (1) an indication of the ISA be provided to an external location; (2) that the spinning body have means for receiving control signals that are synchronized with the indication of the ISA; and (3) that fluid be applied to the fluid expulsion means (the precession jet) in response to the control signals so that the body is precessed in a predetermined direction.[21] It is clear that these elements come into play after the ground control has determined (1) the orientation of the spin axis of the body in a fixed external coordinate system; (2) the desired orientation of the spin axis; and (3) where during the spin angle the precession jet must be pulsed to precess the spin axis towards the desired orientation. Up to this point there is no need for the ground control to know what the ISA is. In the scheme of the claim, the ground control next will send a control signal synchronized with the particular point in the spin period during which the precession jet should be pulsed. The spinning body then has means for pulsing the precession jet in response to the control signal.

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[21] Although other elements are claimed in this portion of the claim, these are the only elements that need be considered here.

In order to permit the ground control to pulse the precession jet during the proper portion of the spin cycle, there must be a known fixed time period between the receipt of a control signal and the activation of the precession jet. In the exemplary embodiment disclosed in the Williams patent, the fixed time period is as close to zero as possible. The only delay is the time it takes the signal to travel through the electronic circuitry and the time it takes to actuate the valve.

Claim 1, then, calls for a spinning body having (1) means for providing information sufficient to determine the ISA to an external location and (2) means for pulsing the precession jet within a fixed time period after the receipt of a control signal from the remote location. Thus, even though the ground control itself is not an element of the claim, the structure called for on the spinning body limits the claim to an attitude control system wherein a ground controller is needed to determine the ISA and use it to pulse the precession jet during the desired portion of the spin cycle.

Skynet II, NATO II, DSCS II

The store and execute attitude control systems are different from the claimed system in that the ISA is used on board the spacecraft instead of on the ground to pulse the precession jet during the desired portion of the spin cycle. In the Skynet II, NATO II, and DSCS II systems, the satellite sends information to the earth control station from which the orientation of the spin axis of the satellite can be determined, as well as the spin rate of the satellite. However, there is no means on the satellite for providing the earth with enough information from which the ISA can be determined.

After determining the orientation of the satellite, the ground control decides whether a change is needed. If needed, the ground control formulates a command to operate the precession jet at a particular desired point in the spin cycle. Earth or sun sensors located on the satellite provide the needed synchronization pulses. Thus, the ground control, knowing the orientation of the satellite in a fixed external coordinate system and knowing the spin rate, determines how long after the synchronization pulse the precession jet should be fired. This command is sent to and stored on board the satellite. This command information is then relayed back to the earth control station and compared with the original to be sure they are identical. Next, the control station sends the execute command. Upon receipt of this command, the satellite implements the original command by waiting until the next synchronization pulse and then firing the precession jet after the time specified in the original command has elapsed.

Claim 1 of Williams requires (1) means for providing an indication of the ISA to an external location, and (2) means for pulsing the precession jet within a fixed time period after the receipt of the control signal. Neither of these two claimed elements can be shown in the structure of the accused Skynet II, NATO II and DSCS II systems. Therefore, as claims 2 and 3 of Williams also include this subject matter, it is clear that the claims of Williams do not literally read on the structure of these satellites.

IMP (H and J), Pioneer (10 and 11)

IMP (H and J) and Pioneer (10 and 11) (the programmed mode) have attitude control systems that are very similar to those found in Skynet II, NATO II and DSCS II, described above. The significant difference

for the purposes of this issue is that the IMP (H and J) and Pioneer (10 and 11) send information to the ground control from which the ISA could be determined. (See para. 10(e) of plaintiff's Rule 111 submission and defendant's response.) This information, however, is not used by the ground control for attitude control in either IMP (H and J) or the programmed mode of Pioneer (10 and 11). Apparently, it is used to aid in analyzing the scientific data. Thus, in each of these systems the ground control sends a command to the spinning spacecraft indicating the direction in which the spacecraft is to be precessed. This command is stored in the spacecraft and relayed back so that ground control knows that the correct information has been stored. Ground control then sends an execute signal to the spacecraft. Using the synchronization pulse on the spacecraft, the original command is implemented by pulsing the precession jet during the proper portion of the spin cycle.

The claims of Williams require means for pulsing the precession jet within a fixed time period after receipt of the control signal. Neither the command nor the execute signal of these two systems operate to activate a precession jet within a fixed time period after the signal is received. Thus, even though an indication of the ISA is sent to an external location, the claims of Williams do not literally read on the accused IMP (H and J) system or the programmed mode of the Pioneer (10 and 11) system.

The Plaintiff's Arguments

Prior to the filing of the supplemental briefs, plaintiff had conceded that the claims of Williams did not literally read on the store and execute systems and that the only way the accused systems could be found to be infringing was by virtue of the doctrine of equivalents. On page 4 of plaintiff's posttrial reply brief, plaintiff states:

> The Government leads off * * * with a long argument addressed to a point not in dispute—namely that the claims of the patent in suit do not literally "read" on the store-and-execute spacecraft. (Hughes has acknowledged that all along. * * *)

Plaintiff now (in the supplemental posttrial briefs) makes the contradictory argument that the claims do literally read on the accused store and execute spacecraft. Plaintiff goes on to make the rather surprising argument that plaintiff never admitted the claims did not read on the spacecraft. These arguments can be dismissed summarily.

First, it is clear from a reading of plaintiff's posttrial papers, including the remark quoted above, that plaintiff has already conceded that none of the claims literally read on any of the accused store and execute systems.

It is, of course, well known that an admission conclusively establishes, for purposes of the pending action, the matter admitted. While procedures exist to enable a party to withdraw its admission, plaintiff in this instance has not shown that it acted with due diligence to be relieved of the admission or that defendant would not be prejudiced by the withdrawal.

Plaintiff's mere pronouncement of a contrary position in its supplemental posttrial briefs is hardly adequate to release it from its prior admission.

The only remaining question is how, if at all, the decision made by the court in *Hughes Aircraft Co. v. United States*, 226 Ct. Cl. ——, 640 F.2d 1193, 208 USPQ 785 (1980), affects this issue.

The plaintiff claims that the findings of fact adopted by this court define the instantaneous spin angle position differently from the way defendant defined it in its proposed findings of fact. Defendant's definition,[22] which is equivalent to the definition I have used throughout this opinion, reads as follows:

> The instantaneous spin angle position of a spacecraft is an indication or representation of where the spacecraft is in its 360 degree spin cycle (rotation) about its spin axis (axis of rotation) at any given instant of time.

Plaintiff then points to finding of fact 35 (adopted by the court) and claims that the court's discussion of the ISA omits any requirement that the "indication of the ISA position be as of a 'given' or specified 'instant of time.'" Plaintiff's language, however, is confusing because "ISA" is the quantity being defined and there is no requirement that this quantity be as of a "given" or specified "instant of time." All that is needed to determine the ISA is to know the angular position of the body for any given instant of time. This information can be given in advance for future instants of time.

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[22] Plaintiff in its objections to defendant's proposed findings agreed that this definition was "factually accurate."

Plaintiff points to finding 35 as a definition of the ISA and then argues that a satellite which sends the spin rate to the ground controller (as all of the store and execute spacecraft do) meets the definition. This can only be viewed as an argument made in desperation. Finding 35, when read in the context of the other findings, and especially finding 41, simply does not support plaintiff's position. As should be clear by now, the spin rate is only one of the pieces of information needed to determine the ISA.

It will be recalled that the claims of Williams also require means for pulsing the precession jet within a fixed time period after the receipt of a control signal. Plaintiff admits that in Williams the jet is activated directly upon receipt of the control signal while in the store and execute systems the command signal is first stored and verified. The later execute signal in the store and execute systems sets the original command into action but there is no fixed time interval between the receipt of the execute signal and the firing of the precession jet. No command signal is synchronized with the ISA. There is no structure on the store and execute spacecraft which acts to pulse the precession jet within a fixed time period after the receipt of a control signal. Plaintiff argues, however, that this difference—

> [I]s of no consequence because of the inert and benign characteristics of space, and there is no need for any immediate reaction to the occasional requirement of precession.

This comment, however, has nothing to do with the requirements of Williams claims which plaintiff has conveniently chosen to ignore. It bears repeating that

it is the claims which define the boundaries of the protected invention.

File Wrapper Estoppel and the Doctrine of Equivalents

As the claims of the Williams patent do not literally read on the store and execute systems, plaintiff's only argument is that the doctrine of equivalents acts to expand the scope of the claims to cover the accused systems. However, as will be seen below, this doctrine does not help plaintiff in this case.

The doctrine of equivalents acts to cast a prenumbra around the literal claim language which must also be avoided if there is to be no infringement. Autogiro Co. of America v. United States, 181 Ct. Cl. 55, 66- 67, 384 F.2d 391, 400, 155 USPQ 697, 704-05 (1967). In order to find equivalence and thus infringement, the court must find that the accused structure performs substantially the same function in substantially the same way and for substantially the same purpose as set forth in the claims. Id. The rationale for the doctrine was set forth by the Supreme Court in Graver Tank & Mfg. Co. v. Linde Air Products Co., 339 U.S. 605, 607, 85 USPQ 328, 330 (1950):

> [T]o permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant to a hollow and useless thing. Such a limitation would leave from for—indeed encourage—the unscrupulous copyist to make unimportant and insubstantial changes and substitutions in the patent which, though adding nothing, would be enough to take the

> copied matter outside the claim, and hence outside the reach of law.

One of the guideposts used in determining the range of equivalents to be given is to determine whether the patent is a pioneer patent. As courts generally give pioneer patents wider ranges of equivalents than minor improvement patents, plaintiff's first argument in this area is to claim pioneer status for the Williams patent. Autogiro Co., at 67, 384 F.2d at 400, 155 USPQ at 705.

In Westinghouse v. Boyden Power Brake Co., 170 U.S. 537, 561-62 (1898), the Supreme Court defined "pioneer" invention as follows:

> This word, although used somewhat loosely, is commonly understood to denote a patent covering a function never before performed, a wholly novel device, or one of such novelty and importance as to mark a distinct step in the progress of the art, as distinguished from a mere improvement or perfection of what had gone before.

In order to decide whether any of the three tests have been met, the Williams patent must be put in the context of the prior art. Tate Engineering, Inc. v. United States, 201 Ct. Cl. 711, 719-20, 477 F.2d 1336, 1340-41, 175 USPQ 115, 118, 178 USPQ 365 (1973).

Put another way, the Supreme Court in Singer Mfg. Co. v. Cramer, 192 U.S. 265, 277 (1904), when it was called upon to apply the test it previously had announced in Westinghouse stated:

> To ascertain whether the patented invention of Cramer is entitled to be embraced within the term pioneer as just defined [the Westinghouse defini-

tion], we will consider it in connection with the state of the art.

The prior art references which are relevant to my consideration of whether the Williams patent is a pioneer patent have all been discussed before. The Rosen-Williams patent (No. 3,396,920) filed December 30, 1959, and issued August 13, 1968, discloses a spin-stabilized satellite whose orientation is controlled by a ground controller. The orientation problem is solved in Rosen, et al., by stopping the spin, changing the spin axis orientation, and then starting the spin up again. The McLean patent (No. 3,216,674) filed June 8, 1959, and issued November 9, 1965, discloses a spin-stabilized, target-seeking vehicle. McLean used a precession jet offset from the spin axis and pulsed at the appropriate point in the spin cycle of the vehicle to change its orientation. Independent of McLean's work, Williams applied the pulsed precession jet concept of McLean to solve the orientation problem of the remote controlled satellite of the type disclosed by Rosen, et al. This was an important advance in the art and a patent was granted in recognition of this contribution. However, in view of the above-referred to prior art, it is clear that this was not a pioneer invention.

Plaintiff argues that the Williams patent covers "a function never before performed." Although it is true that the space vehicle of McLean was never actually built and thus its disclosed function was never actually performed, I feel that in applying the Westinghouse test, any disclosure in a patent of a device and its associated function which satisfies the requirements of 35 U.S.C. §§101 and 112 should be considered. Thus, all of the functions covered by the claims of Williams have been performed before, either by the Rosen, et al.,

satellite or the McLean space vehicle. Also, it is clear from the prior art that the Williams satellite is not wholly novel. Finally, while it was an important step in the progress of the art, the Williams patent, when viewed in light of the very close prior art, cannot be considered to have reached the level of a pioneering invention.

Before examining whether the accused store-and-execute devices are the equivalent of the Williams claimed invention, the interaction of file wrapper estoppel with the doctrine of equivalents must be discussed.

In this case, the record clearly shows that plaintiff, during the prosecution of the Williams patent application, performed certain acts that limited the range of equivalents to which the claims at bar are entitled. It is settled law that the doctrine of equivalents is subservient to file wrapper estoppel. Autogiro Co. at 67, 384 F.2d at 400, 155 USPQ at 705. The rationale behind file wrapper estoppel is that an applicant who has narrowed his claims in order to overcome prior art during the prosecution before the Patent Office should not be permitted to recapture this subject matter during a later infringement action. As this court said, id. at 68, 384 F.2d at 401, 155 USPQ at 705:

> Thus a patent that has been severely limited to avoid the prior art will only have a small range between it and the point beyond which it violates file wrapper estoppel.

Just prior to the citation of McLean, the plaintiff still had claims 3, 5 and 8-14 in the case. These claims were directed broadly to controlled precession of a spinning body using an offset precession jet pulsed synchro-

nously with the spin of the body. In response to the citation of McLean, plaintiff cancelled claims 3, 5 and 8-14 and added three new claims which are now patent claims 1-3. Each of these claims recited the two elements discussed above in connection with the distinctions between the store and execute systems and the Williams system. These elements had not been previously claimed in claims 3, 5 and 8-14.

The first element is the means for providing an indication of the ISA to an external location. Skynet II, NATO II and DSCS II do not have such a means. The second element is the means for applying fluid to said fluid expulsion means within a fixed time period after the receipt of a control signal. None of the accused store and execute spacecraft have such a means. These elements were added in combination with a number of other elements to overcome the prior art cited. While it may in hindsight appear that one or both of these elements would not have been needed to overcome the examiner's rejection, this is sheer speculation. There is no way of knowing how the examiner would have reacted to such omissions. As plaintiff included these elements in the claims to overcome the prior art, plaintiff is now estopped from claiming that these elements are unnecessary to avoid the art.

As alluded to before, file wrapper estoppel acts to severely limit the range of equivalents to which a claim is entitled. It, however, does not eliminate all equivalents. The range of equivalents to which claims may be entitled after an estoppel has been previously discussed in *Eastern Rotorcraft Corp. v. United States*,

184 Ct. Cl. 709, 717, 397 F.2d 978, 982, 154 USPQ 43, 46, 158 USPQ 294 (1968), where this court said:

> The doctrine of file wrapper estoppel does not necessarily apply to the extent of depriving a patentee of all equivalents. Cancellation of a broad claim precludes an extension of claim coverage by equivalents to encompass the entire scope of the cancelled claim. However, the patentee, after cancellation of a broad claim, is still to be afforded protection against obvious and exact equivalents.

In view of the file wrapper estoppel in this case, the doctrine of equivalents affords protection only against alleged infringers who use obvious and exact equivalents of the elements of the claimed invention. There is no obvious or exact equivalent of plaintiff's means for providing an indication of the ISA to an external location in either of the Skynet II, NATO II or DSCS II systems. Nor is there an obvious or exact equivalent of the means for pulsing the precession jet within a fixed time period after the receipt of a control signal in any of the accused store and execute systems.

For the reasons stated above, it is concluded that none of the accused store and execute systems (Skynet II, NATO II, DSCS II, IMP (H and J), and the programmed mode of Pioneer (10 and 11)) infringe any of the claims of the Williams patent.

The Real Time Systems

The remaining spacecraft systems, which plaintiff alleges infringe the claims of the Williams patent, are referred to, for convenience, as the "real time" systems. There are two real time systems, Solrad (9 and 10) and the real time mode of Pioneer (10 and 11). For the

reasons detailed below, Solrad (9 and 10) and the real time mode of Pioneer (10 and 11) are found to infringe only claim 1 of the Williams patent.

Solrad (9 and 10)

The Solrad (9 and 10) satellites are equipped with an attitude control system capable of functioning in an automatic and a real time mode. Plaintiff makes no argument that the automatic mode infringes the claims of the Williams patent. However, in order to put the real time mode in context, it is important to consider how the automatic mode functions. The Solrad satellites were designed to be placed in orbit around the earth to monitor solar radiation. In order to do so, each of the two satellites was set up to constantly maintain a selected orientation with respect to the sun. Solrad 9's orientation kept its spin axis perpendicular to the sun vector (the line between the sun and the center of mass of the satellite) while Solrad 10 kept its spin axis directed at the sun.

In order to keep these satellites in their proper orientation, an automatic attitude control system was provided. This system included a precession jet disposed on the satellite such that it was spaced from the spin axis and oriented to expel gas substantially along a line parallel to the spin axis. Sun sensors positioned on the satellite provided an indication of the ISA with respect to the sun and an indication of the sun angle (the angle between the spin axis and the sun vector). When the satellite deviated from its preferred orientation with respect to the sun (perpendicular for Solrad 9 and aligned for Solrad 10), the information provided by the sun sensors was automatically used to pulse the precession jet during the proper portion of

the spin cycle so that the satellite was precessed back into its desired orientation.

In sum, since the automatic mode generates the signal to actuate the axially disposed precessing jet on the satellite, without any radio contact with an earth-based control station, it is clear that it does not infringe the Williams patent.

However, each of the Solrad (9 and 10) satellites, in addition to being equipped with an automatic operation mode, is also provided with a real time backup mode. The additional hardware for this mode consisted of a circuit which permitted the precession jet valve to be directly operated by a signal applied from the ground station. It is this so-called real time backup mode that plaintiff claims infringes the claims of Williams. The designers of Solrad (9 and 10) were concerned with the possibility of the failure of the satellites' sun sensors. The real time mode could then be used to provide the needed attitude adjustments from the ground using a fine angle sensor.

The fine angle sensor provided an indication of the instantaneous spin angle position and the angle of the spin axis with respect to the sun vector. This information was relayed to the ground. Normally, this was used to help in interpreting scientific data, but in the case of failure of other sun sensors, this information could be used to determine when a signal to pulse the precession jet should be sent in order to restore the proper orientation.

Defendant points out that ground control has had at all times the capability of pulsing the jet directly from the ground. However, in order to send a pulse that will activate the jet at the proper time in the spin cycle,

some equipment must be provided to do a job similar to that done by the apparatus of Fig. 12 of the Williams patent. Defendant stresses that since the automatic attitude correction system has never failed, the necessary equipment has never been built.

Defendant argues, even though this court found that the ground controller was not an element of the claims of Williams, that the claims still require a control pulse synchronized with the ISA. In view of this court's interpretation of the claims,[23] it is clear that there is no such requirement. The language in question is clause (f) of claim 1 (claims 2 and 3 have equivalent language) which calls for:

> [M]eans disposed on said body for receiving from said [external] location on control signals synchronized with said indication [of the ISA]; * * *.

All that this phrase requires is some means on the body which is capable of receiving synchronized signals. There is nothing in the claim that requires synchronized signals to be provided.

This language, however, is not meaningless surplusage. Indeed, the reference in element (f) to the control signals being synchronized with the indication of the ISA makes the function and structure of the elements that are specifically claimed clear. In view of this language, there can be no doubt regarding the type of

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[23] As previously discussed, this court has found that "the claims of the patent cover solely the orbiting satellite and no other object, device, means, or apparatus." Hughes Aircraft Co. v. United States, 226 Ct. Cl. ——, 640 F.2d 1193, 1195, 208 USPQ 785, 788 (1980).

remote control station that the claimed spinning body is intended to interact with.

In order for defendant to be liable for the unauthorized taking of plaintiff's invention it is necessary to show that the Solrad 9 and 10 satellites were both made or used after the September 11, 1973, issue date of Williams. 28 U.S.C. §1498. Since there appears to be no question that both Solrad 9 and 10 were made before the issuance of the patent, it is necessary for plaintiff to show that these satellites were used during the relevant accounting period. Coakwell v. United States, 178 Ct. Cl. 654, 659, 372 F.2d 508, 511, 153 USPQ 307, 309 (1967), which deals with this very issue, clearly states:

> The fact that certain articles embodying an invention were manufactured before and obtained by the defendant before the patent was issued does not authorize their use thereafter.

It is clear, however, that defendant has used the claimed subject matter in the Solrad 9 and 10 satellites. The fact that the real time mode is used as a backup to the automatic mode and has never actually been put into operation does detract from this conclusion. Use of a system as a backup mode or to provide an extra measure of safety is "use" within the meaning of 28 U.S.C. § 1498. Id.; Olsson v. United States, 87 Ct. Cl. 642, 25 F. Supp. 495, 37 USPQ 767 (1938), cert. denied, 307 U.S. 621, 41 USPQ 799 (1939). Thus, the accused real time Solrad (9 and 10) control systems have been used in accordance with the requirements of 28 U.S.C. §1498.

As will be shown below, the Solrad (9 and 10) real time systems include all of the elements of claim 1.

Claim 1 of Williams requires:

1. Apparatus comprising:

    a. body adapted to spin about an axis;

The Solrad satellites were spin stabilized.

Additionally, claim 1 calls for:

    b. fluid supply means associated with said body;

    c. a valve connected to said fluid supply means;

    d. fluid expulsion means disposed on said body and coupled with said valve and oriented to expel said fluid substantially along a line parallel to said axis and separated therefrom; * * *.

The Solrad satellites each had a nozzle oriented parallel to the spin axis and connected through a valve to a tank of gas.

Clause (e) of claim 1 requires:

    e. means disposed on said body for providing an indication to a locationexternal to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system; * * *.

The Solrad satellites each provided an indication of the ISA with respect to the sun (previously assumed to be a fixed point in a fixed external coordinate system) to the ground control for purposes of processing the scientific data. This ISA indication was provided by a fine angle sensor independently of the sun sensors used

for the automatic orientation mode. It was contemplated that if the orientation sun sensors failed that the ISA used for the experiments could have been used to provide the needed synchronization to operate in the real time mode. The Solrad satellites also provided an indication of the orientation of the spin axis in a fixed external coordinate system.

Finally, claim 1 requires:

> f. and means disposed on said body for receiving from said location control signals synchronized with said indication;
>
> g. said valve being coupled to said last-named means and responsive to saidcontrol signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

Both Solrad satellites had a circuit which permitted the precession jet valve to be directly operated by a signal from ground control. Thus, as all of the elements of the claim have been shown in the Solrad (9 and 10) systems, claim 1 is infringed.

Claims 2 and 3 of Williams incorporate substantially all of the subject matter of claim 1 along with some additional limitations. The significant added limitations are that claim 2 requires "wide angle means" and claim 3 requires "wide angle optical means" for providing the ISA and orientation indications.

Plaintiff has the burden of proof on the issue of infringement. *Roberts Dairy Co. v. United States*, 208

Ct. Cl. 830, 851, 530 F.2d 1342, 1357, 182 USPQ 218, 227, 198 USPQ 383 (1976). Plaintiff, however, has never set forth all of the elements of the claims and pointed out where each of the elements can be found in the accused structure. In the case of Solrad (9 and 10), plaintiff is apparently attempting to put the burden on the defendant to show that these satellites do not infringe. On page 33 of plaintiff's posttrial brief, plaintiff makes the conclusory statement that:

> SOLRAD's * * * "real time" mode, was designed to operate in faithful conformity to the Williams teaching.

The record cited for this proposition supports only a statement that the Solrad's real time mode is intended to be operated in a manner very similar to the operation of the Williams satellite. There is, however, no comparison of the claims with the structure of Solrad nor any showing that the Solrad real time mode was intended to be operated in "faithful conformity" to the Williams patent in any of the citations. On page 43 of the same brief, the plaintiff refers to the above-quoted assertion and states that the Government does not deny it.

The fact that the Government has not denied it does not mean defendant had admitted that the Solrad satellites operate in faithful conformity to the teachings of the Williams patent. Plaintiff is still required to make a prima facie case.

Although plaintiff has produced sufficient evidence to show infringement of claim 1, plaintiff has failed to meet its burden with respect to claims 2 and 3. These claims require wide angle means for providing the ISA and orientation indications. While each of the Solrad satel-

lites had wide angle optical sensors, there is no indication from the record that these wide angle sensors were intended to be or could be used to provide indications of the ISA and orientation in a real time backup mode.

The fine angle sensor, intended to be used in the real time backup mode, had a field of view of about 10°. Although the term "wide angle" does not provide a definite cutoff, it is clear from plaintiff's ante litem motam arguments, made in distinguishing McLean on this basis, that a 10° field of view is not a wide angle field of view.[24]

Plaintiff has not pointed to any other element in the Solrad (9 and 10) satellites which meets the requirement of claims 2 and 3 for wide angle means which provide an indication of the ISA and orientation to a location external to the satellites. Nor has plaintiff pointed to any structure of the Solrad satellites which is the equivalent of the claimed means. Thus, the Solrad (9 and 10) satellites do not infringe claims 2 and 3 of the Williams patent.

The Real Time Mode of Pioneer (10 and 11)

Pioneer (10 and 11), unlike the other accused spacecraft, are not satellites. These spacecraft were designed to explore our solar system and in particular to investigate the interplanetary medium, the nature of the Asteroid Belt, and the environmental and atmospheric characteristics of the planet Jupiter. For the purposes of this case, the two spacecraft (Pioneer 10 and 11) can be considered as being identical. Here-

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[24] Plaintiff argued that the 8-10° field of view of the sensor of McLean was not a wide angle field of view in the sense of the claims.

inafter, a reference to "Pioneer" includes both spacecraft.

Like all the other accused spacecraft, Pioneer is spin stabilized. Pioneer has three attitude control modes: automatic, programmed precession, and real time. All of these modes use a precession jet offset from the spin axis and pulsed at the appropriate time of the spin cycle in order to change orientation. The automatic mode is called "Conscan" (conical scan), and acts to maintain the spin axis pointed in the direction of an r.f. (radio frequency) signal emanating from the earth This automatic mode is similar to the automatic attitude control system of the McLean patent in that both act to automatically align the spin axis with a target. The plaintiff makes no argument that this mode infringes any of the claims of Williams.

The programmed mode was discussed in the store and execute section of this opinion and is very similar to the Skynet II, NATO II and DSCS II systems. This mode is used where it is necessary to make a course and/or velocity correction. The precise direction in which the onboard rocket must be fired is determined on the ground. The store and execute (programmed) mode is then used to orient the spacecraft so that the rocket points in the proper direction. The correction is made by firing the rocket for a predetermined period and then the spacecraft is returned to the automatic earth pointing mode. It has previously been determined that this mode does not infringe any of the claims of Williams.

The real time mode was designed as a backup system to be used in case of failure of one or more of the primary attitude control systems. Like Solrad, this system includes a circuit which can be activated by a

signal from the ground. Upon receipt of the signal, the precession jet is immediately pulsed. There has never been a need to use this backup circuit. It is clear, however, that a number of different uses were contemplated based on the various possible failures that could be envisioned. At least one of these contemplated modes of uses involved determining the ISA and orientation of the spacecraft with respect to a fixed external coordinate system on the ground from indications provided by the spacecraft.

In order to properly precess the spacecraft in this mode, the signal sent to activate the precession jet circuit must be sent in synchronism with the ISA. In order to do this, the ground control must be provided with equipment capable of performing the synchronizing function. (See, for example, Fig. 12 of Williams.) This equipment has never been built because the primary systems have all continued to function properly. As decided previously in connection with Solrad, however, the fact that the ground control equipment has never been built does not act to relieve defendant of infringement.

First, in view of this court's earlier opinion, there is no requirement in any of the claims that a control signal synchronized with the ISA be provided. Only the capability to receive such a signal is claimed. Secondly, use as a backup system is use in accordance with the requirements of 28 U.S.C. §1498. Coakwell v. United States, 178 Ct. Cl. 654, 372 F.2d 508, 153 USPQ 307 (1967); Olsson v. United States, 87 Ct. Cl. 642, 25 F. Supp. 495, 37 USPQ 767 (1938), *cert. denied*, 307 U.S. 621, 41 USPQ 799 (1939).

As will now be shown, each element of claim 1 of Williams can be found in the Pioneer spacecraft.

Claim 1 of Williams calls for:

1. Apparatus comprising:

   a. a body adapted to spin about an axis; * * *

The Pioneer spacecraft is spin stabilized.

In addition, the claim also requires:

   b. fluid supply means associated with said body;

   c. a valve connected to said fluid supply means;

   d. fluid expulsion means disposed on said body and coupled with said valve and oriented to expel said fluid substantially along a line parallel to said axis and separated therefrom; * * *.

Pioneer has a nozzle oriented parallel to the spin axis and connected through a valve to a gas supply tank.

Clause (e) of the claim provides:

   e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system.

Pioneer's sun sensor provides an indication to ground control of the ISA with respect to the sun. The orientation of the spin axis with respect to a fixed coordinate system can be determined from the telemetered Conscan phase and amplitude data. The Conscan system uses a medium gain directional antenna, offset from the spin axis by about 9.3°. As the r.f. (radio frequency)

signal from earth is received by the antenna, the Conscan system generates amplitude and phase data which is relayed to earth. This data indicates the degree to which the spin axis is out of alignment with the earth. When this data indicates that the spin axis is pointing at the earth, the orientation of the spin axis in a fixed coordinate system is known.

The Pioneer Program Document No. PC202 suggests on p. 5-3 that even if the Conscan function fails the Conscan telemetry of phase and amplitude data might remain. If, however, the Conscan telemetry has failed as well, document No. PC202 suggests that the orientation can be determined by dead reckoning using the time that Conscan last indicated that the spin axis was pointing at the earth, the rate of change of orientation in inertial space of the spacecraft- earth line, and the magnitude and direction of solar torques acting on the spacecraft.

Finally, claim 1 calls for:

> f. and means disposed on said body for receiving from said location controlsignals synchronized with said indication;
>
> g. said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

The Pioneer spacecraft each have a circuit which acts to pulse the precession jet immediately upon receipt of a control signal. Thus, as all of the elements of the

claim have been shown in the Pioneer (10 and 11) real time system, claim 1 is infringed.

Claims 2 and 3 of Williams incorporate substantially all of the subject matter of claim 1 along with some additional limitations. The significant added limitations are that claim 2 requires "wide angle means" and claim 3 requires "wide angle optical means" for providing the ISA and orientation indications. Pioneer's sun sensor covers a field of view of 170°. This is clearly wide angle and optical. However, this sensor provides no indication of the sun angle (the angle between the spin axis and the line from the sun to the spacecraft).

The orientation is determined by the medium gain Conscan antenna. This antenna determines pointing errors of about 10°. The "field of view" of this antenna then is about 20°. Although the term "wide angle" does not provide a clear cutoff, some guidance on the question of how wide the angle must be can be obtained from plaintiff's *ante litem motam* arguments made in distinguishing McLean on this basis. The field of view of the sensor of McLean is about 8° to 10°. Plaintiff argued that this is not a wide angle in the sense of the claims, pointing out that the solar sensor of Williams has a field of view of 140°. Although it is still not clear where the cutoff between the wide angle and narrow or medium angles is, it is clear that 20° is not a wide angle field of view.

Plaintiff has not pointed to any other element which meets the requirement of claims 2 and 3 for wide angle means which provide an indication of the orientation of the spin axis. Nor has plaintiff pointed to any structure of Pioneer which is the equivalent of the claimed element. Thus, Pioneer (10 and 11) does not infringe claims 2 and 3 of the Williams patent.

Conclusion

For the reasons detailed above, it is found that claims 1, 2 and 3 of United States Letters Patent No. 3,758,051 are valid and enforceable. Further, it is found that the accused Solrad (9 and 10) and Pioneer (10 and 11) systems have been used and/or manufactured by or for the defendant without authorization or license from the plaintiff and infringe claim 1. Claim 2 and 3 are not infringed by the Solrad (9 and 10) or Pioneer (10 and 11) systems. Claims 1, 2 and 3 are not infringed by any of the accused Skynet II, NATO II, DSCS II, or IMP (H and J) systems.

APPENDIX C

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

No. 426-73

HUGHES AIRCRAFT COMPANY, APPELLANT

v.

THE UNITED STATES, APPELLEE

Sept. 20, 1983

Before MARKEY, Chief Judge, and DAVIS and BALDWIN, Circuit Judges.

MARKEY, Chief Judge.

Hughes Aircraft Company (Hughes) appeals that part of a judgment[1] of the United States Claims Court finding non-infringement of U.S. patent No. 3,758,051 (the Williams patent) by the government's "store and execute" (S/E) spacecraft. The government appeals that part of the judgment holding claims 1, 2, and 3 of the patent valid. We affirm-in-part, reverse-in-part, and remand for a determination of the quantum of recovery for infringement by the accused SKYNET II,

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[1] Pursuant to an October 4, 1982 order of this court, the trial judge entered a final judgment on October 8, 1982, corresponding to the decision recommended in this case.

NATO II, DSCS II, IMP (H and J), SOLRAD (9 and 10), and PIONEER (10 and 11) [2] spacecraft.

The Williams patent for "Velocity Control and Orientation of a Spin-Stabilized Body", issued to Donald D. Williams on September 11, 1973, on application serial No. 391,187, filed August 21, 1964, a continuation-in-part of now- abandoned application serial No. 22,733, filed April 18, 1960.

Background

Throughout the late 1950's and early 1960's, the Department of Defense and the National Aeronautics and Space Administration (NASA) engaged in an intense effort to build a synchronous communications satellite with an orbital period equalling the rotational period of the earth. The goal was a satellite moving in a west-to-east orbit with a radius of 22,750 nautical miles and having a linear velocity of 10,090 feet per second, so that it could "hover" above a fixed point on earth.

Despite huge expenditures, the government never solved the technical problem of attitude control. That problem is described as the need to orient the satellite in space, without exceeding weight limitations, while insuring that (1) its directional antennas were always pointed toward the earth, and (2) that it would obtain a reliable, adequate fuel supply from the sun.

Working for Hughes, Williams solved the problem. He created a practical system for attitude control of a

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[2] PIONEER, initially expected to function for 21 months, continued its galactic journey for 11 years. It has recently become the first man-made structure known to have entered "deep" space as it continues its journey toward infinity. *Washington Post*, June 13, 1983.

spin-stabilized satellite. In the Williams system, signals sent by a ground crew control the satellite by causing a jet on the satellite to pulse at a selected satellite position in successive spin cycles, thereby "precessing" the satellite in a selected direction. Williams taught how a jet valve on the satellite's periphery could discharge gas in brief, successive pulses on command. He taught that an on-board V-beam sun sensor (vertical slit and canted slit) could collect raw data from the sun and transmit it to earth, enabling a ground crew to determine the satellite's existing and desired orientations.

When, using conventional radio signals, the ground crew pulses the attitude jet, torque is applied to the satellite and its spin axis is "precessed" parallel to the earth's axis, causing the beam of the satellite's antenna to point to the earth continuously during the 24-hour period of each orbit, and insuring that the satellite's solar cells receive maximum light from the sun.

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The Williams Satellite

On April 2, 1960, Williams successfully operated a laboratory model, known as the "dynamic wheel", in demonstration of his invention. *See Williams v. Administrator of NASA*, 463 F.2d 1391, 1395-96, 175 USPQ 5, 8-9 (Cust. & Pat. App. 1972), cert. denied, 412 U.S. 950, 93 S. Ct. 3013, 37 L.Ed.2d 1003 (1973).

Hughes disclosed the invention to NASA, seeking its participation in building a satellite with the unique attitude control system. In its "Sole Source Justification", NASA stated:

> Hughes has submitted the only proposal to NASA indicating that a 24-hour lightweight synchronous satellite having a two-way voice communication capability is practicable. This design is achieved through the use of a unique attitude and orbital velocity vernier system which allows an optimized communication system to meet the requirements for two-way voice communication within the weight limitations.
>
> Utilization of the development team and design approaches established at Hughes will result in a savings in time and money to the Government. It is therefore recommended that a sole source procurement of a spacecraft for Project SYNCOM be awarded to Hughes Aircraft Corporation.

In August, 1961, Hughes and NASA entered a contract for engineering and construction of the SYNCOM satellite. On July 26, 1963, SYNCOM II, the world's first synchronous communications satellite, was launched and placed in orbit. On July 31, 1963, the attitude control system was successfully employed and radio transmission continued 24 hours per day.

On April 18, 1960, Williams had filed the parent application of that which resulted in the Williams patent. The examiner allowed some claims, but rejected others based on prior art and an inadequate disclosure of ground control apparatus. Williams' proffered amendments were denied entry as containing new matter.

On August 21, 1964, Williams filed a continuation-in-part (CIP) application. The CIP added to the parent disclosure a Figure 12 and a description of the structure it illustrated, *i.e.*, a ground-based analog controller for

synchronizing the force applied to the satellite with the satellite's spin cycle.

On January 10, 1966, the examiner rejected all claims under 35 U.S.C. § 103 as unpatentable over earlier cited art and newly cited U.S. patent No. 3,216,674 entitled "Proportional Navigation System for a Spinning Body in Free Space", issued November 9, 1965 to McLean and disclosing a spin-stabilized, target-seeking space vehicle having a jet motor on its periphery. The motor, controlled by an infrared sensor, automatically precessed the vehicle to keep its spin axis pointed toward the target.

The McLean vehicle for steering a collision course to a target is self- contained and self-guiding. When the target is aligned with the vehicle's spin axis, photodetector 22 detects a constant infrared radiation, producing a constant signal. If the target moves from alignment, detector 22 provides an alternating signal, to fire precessing jet 16 at the point in the vehicle's spin cycle that will precess the spin axis back toward the target.

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The McLean Space Vehicle

By amendment filed April 29, 1966, Williams canceled the rejected broad claims and inserted three independent claims that became claims 1-3 of the patent in suit. Representative claim 1 reads:

1. Apparatus comprising:

a. a body adapted to spin about an axis;

b. fluid supply means associated with said body;

c. a valve connected to said fluid supply means;

d. fluid expulsion means disposed on said body and coupled with said valve and oriented to expel said fluid substantially along a line parallel to said axis and separated therefrom;

e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;

f. and means disposed on said body for receiving from said location control signals synchronized with said indication;

g. said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

In accompanying remarks, Williams said "[t]hese claims were re-written . . . so that the claims more clearly distinguish over the newly-cited reference, McLean" and "[a]s to McLean, he does not teach or suggest the elements and relationships set out in [paragraphs (e), (f), and (g)]". Placing emphasis on paragraph (e), Williams said: "McLean's infrared telescope does not indicate the instantaneous spin angle position of his body *with reference to a fixed external coordinate system, and it does not indicate the orientation of the axis with reference to a fixed external* coordinate

system. [Emphasis in original.]" On May 4, 1966, the examiner allowed the claims.

The Administrator of NASA asserted that he was entitled to receive the patent, on behalf of the United States, pursuant to § 305 of the National Aeronautics and Space Act, 42 U.S.C. § 2457. The Patent Office Board of Patent Interferences agreed, viewing the launching and maneuvering of SYNCOM II accomplished under government contract as constituting the first actual reduction to practice of the invention. The Court of Customs and Patent Appeals reversed, holding that the earlier, successful operation of the "dynamic wheel" had

> unquestionably met the requirements for actual reduction to practice. Hughes' experts promptly adapted the present attitude control system in place of a different system originally planned for its Comsat program, which it was offering to government agencies and others. NASA, obviously as the result of consideration by its technical staff and advisors of the program and the Hughes activities under it, including the dynamic wheel test, entered into the 1961 contract for the Syncom program at the risk of millions of dollars.
>
> For the above reasons, we conclude that the invention was actually reduced to practice before, and outside of, the NASA contract and that the board's determination to the contrary was erroneous. [*Williams v. Administrator of NASA*, 463 F.2d at 1399-1400, 175 USPQ at 11, footnote omitted.]

In the Administrator's brief in the Court of Customs and Patent Appeals, he referred to the Williams invention as "an invention in a sophisticated art, involving

new and unobvious subject matter". In his Petition for Writ of Certiorari filed with the Supreme Court, he characterized the patent in suit as "an important patent on an invention used in space satellites".

On September 11, 1973, the Williams patent issued, with Hughes as assignee. On November 13, 1973, Hughes filed this action in the Court of Claims under 28 U.S.C. § 1498, seeking reasonable and entire compensation for the unauthorized manufacture or use by the United States of the claimed invention in the government's SKYNET II, NATO II, DSCS II, IMP (H and J), SOLRAD (9 and 10), and PIONEER (10 and 11) spacecraft. The government disputed validity and denied infringement.

The trial judge submitted a recommended decision and conclusion of law, *Hughes Aircraft Co. v. United States*, 205 USPQ 381 (Trial Div., Ct.Cl.1979), finding that: (1) the ground controller shown in Figure 12 of the patent was an element of all three claims; (2) those claims were restricted to the filing date of the CIP application and were not entitled to the benefit of the parent application's filing date, because the parent provided inadequate support under 35 U.S.C. §§ 120 and 112, first paragraph; and (3) the claims were invalid under 35 U.S.C. § 102(b), because the invention claimed had been described in a printed publication more than one year before the filing date of the CIP application.[3]

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[3] The relevant statutory provisions are:

§ 120. *Benefit of earlier filing date in the United States*

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, by the same inventor shall have the same effect, as to such invention, as though filed on the

In *Hughes Aircraft Co. v. United States*, 640 F.2d 1193, 1195, 208 USPQ 785, 788 (1980), the Court of Claims rejected the trial judge's conclusion, stating "[t]he claims of the patent cover solely the orbiting satellite and no other object, device, means or apparatus." The court held that "The Williams patent is not invalid under 35 U.S.C. § 102(b)." The case was remanded for a recommended decision and findings on the other issues presented. *Id.* at 1199, 208 USPQ at 791.

Decision on Remand

On September 1, 1982, the trial judge submitted a recommended decision and conclusion of law on remand. *Hughes Aircraft Company v. United States*, 215 USPQ 787. In an exhaustive opinion, he rejected the defense of

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date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

§ 112. *Specification*

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

§ 102. *Conditions for patentability; novelty and loss of right to patent*

A person shall be entitled to a patent unless—

. . .

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States . . .

invalidity under 35 U.S.C. § 112, held that the claimed subject matter would have been nonobvious under 35 U.S.C. § 103,[4] and found that the patent is infringed by the accused "real-time" spacecraft but not by the accused S/E spacecraft. Specifically, he found that claim 1 is infringed by the SOLRAD (9 and 10) and PIONEER (10 and 11) "real-time" spacecraft, and that no claim is infringed by the SKYNET II, NATO II, DSCS II, or IMP (H and J) S/E spacecraft.

The trial judge acknowledged the similarities between the S/E spacecraft and the Williams satellite:

> The store and execute systems have many elements that are similar, if not identical, to the system described in the Williams patent. Each of the systems includes (1) a spin-stabilized spacecraft; (2) means for determining the orientation of the spin axis of the spacecraft from the earth; (3) means for signaling from the earth to the spacecraft that a change in orientation is desired; (4) a precession jet mounted on the spacecraft offset from the spin axis; and (5) means for pulsing the offset jet in synchronism with the spin of the spacecraft so that the spin axis is precessed in the desired direction. The

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[4] 35 U.S.C. § 103 reads:

§ 103. Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

> Williams system includes all of these elements. [215 USPQ at 807]

Nonetheless, in concluding that no claim is infringed by the accused S/E spacecraft, he emphasized the literal language of the claims:

> [I]t is basic in patent law that the claims . . . define the scope of invention. 35 U.S.C. § 112, second paragraph. No matter how fair or equitable it may seem, a court cannot rewrite the claims. *Autogiro Co. of America v. United States*, 181 Ct. Cl. 55, 60, 384 F.2d 391, 396, 155 USPQ 697, 701 (1967). [215 USPQ at 807]

He found that Williams' claims require: (1) means for providing to an external location information sufficient to determine the instantaneous spin angle (ISA) position; and (2) means for pulsing the precession jet within a fixed time after receipt of a control signal from that location. Finding that the SKYNET II, NATO II, and DSCS II spacecraft contain neither of those requirements, and the IMP (H and J) spacecraft do not contain the latter, he concluded that no S/E spacecraft literally infringes the claims.

> Respecting Hughes' reliance on the doctrine of equivalents, the trial judge said: As plaintiff included these elements in the claims to overcome the prior art [the McLean patent], plaintiff is now estopped from claiming that these elements are unnecessary to avoid the art

and

> In view of the file wrapper estoppel in this case, the doctrine of equivalents affords protection only against alleged infringers who use obvious and exact equivalents of the elements of the claimed invention.

> There is no obvious or exact equivalent of plaintiff's means for providing an indication of the ISA to an external location in either [sic] of the SKYNET II, NATO II or DSCS II systems. Nor is there an obvious or exact equivalent of the means for pulsing the precession jet within a fixed time period after the receipt of a control signal in any of the accused store and execute systems. [215 USPQ at 812]

Accordingly, he concluded that none of the accused S/E spacecraft infringes any of the Williams patent claims.

The government has not appealed from the judgment that the SOLRAD and PIONEER spacecraft infringe claim 1 of the patent in suit. It does argue invalidity of the Williams patent, however, and if the patent be held invalid, the infringement judgment would fall, liability for infringement of an invalid patent being non-existent in law.

Issues

I. Whether the Williams patent is invalid because a parent application did not comply with 35 U.S.C. § 112, first paragraph.

II. Whether Williams' claimed subject matter would have been obvious, 35 U.S.C. § 103.

II. Whether Williams' claims are infringed by any of the accused "store and execute" spacecraft.

OPINION

I. Validity

(A) *35 U.S.C. §§ 112, 120, 102(b)*

The government argument that the Williams patent is invalid because a parent application was not enabling under 35 U.S.C. § 112 relies on this language in the previous Court of Claims opinion, *Hughes Aircraft Co. v. United States*, 640 F.2d at 1198, 208 USPQ at 790:

> The problem with the original [parent] application with respect to the ground control device was not the failure to claim such a device (since it was not a part of the invention), but to give sufficient information regarding the ground control device to enable one skilled in the art to practice the invention.
>
> It was this deficiency in the information about the ground control device contained in the original application that the amplification of the specifications in the CIP application was designed to correct [Emphasis in original].

The government couches this defense in traditional terms, i.e., "failure to comply with § 112, first paragraph". It makes no effort however, nor could it, to show that the Williams *patent* fails to comply with § 112. As above indicated, it is necessary that Williams be entitled to his parent application's filing date under § 120, if he is to avoid the effect of the publication under § 102(b). The government, in asserting non-entitlement to the earlier date, is thus attempting to relitigate the § 102(b) issue. That it cannot do.

Whatever may be said of the language the government relies on, that language cannot be considered in a vacuum or out of context. The Court of Claims expressly held that "The Williams patent is not invalid under 35 U.S.C. § 102(b)", *Hughes*, 640 F.2d at 1199, 208 USPQ at 791. To avoid invalidity under § 102(b), the

Williams patent must necessarily have been entitled to the parent application's filing date, and, to be so entitled under 35 U.S.C. § 120, the parent must have been enabling under § 112 with respect to the invention set forth in the claims of the patent. The trial judge indicated that the invention referred to by the court in the government- cited language was not that set forth in the claims finally allowed. That language, moreover, may be viewed as premised on there having been sufficient enablement present in the parent application, the CIP having merely added an "amplification". In any event, we view the holding of the Court of Claims that the Williams patent is not invalid under § 102(b) as encompassing validity under § 112 and as the law of the case.

(B) *35 U.S.C. § 103*

A patent shall be presumed valid and the burden of persuasion is and remains always on the party asserting invalidity. 35 U.S.C. § 282. *Stevenson v. ITC*, 612 F.2d 546, 551, 204 USPQ 276, 281 (Cust. & Pat. App. 1979); *Solder Removal Co. v. ITC*, 582 F.2d 628, 632-33, 199 USPQ 129, 132-33 (Cust. & Pat. App. 1978). The burden is less easily carried when the evidence relied upon consists only of the prior art considered by the examiner. *See Solder Removal*, 582 F.2d at 633, 199 USPQ at 133.

The government argues that because the subject matter of claims 1, 2, and 3 would have been obvious at the time the invention was made to a person having ordinary skill in the art, the Williams patent is invalid under 35 U.S.C. § 103. It relies heavily on the McLean patent considered by the examiner. The trial judge found, and the parties agree, that McLean is the most pertinent prior art. According to the government,

McLean's space vehicle includes all elements recited in the claims except for a remote control capability, which it says would have been an obvious addition thereto.

As the trial judge noted, the argument fails because the premise is unsound, *i.e.*, "the device of McLean does not include all of the elements of the claims of Williams, except for remote control." Among the elements not disclosed by McLean is that of paragraph (e) of claim 1:

> e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;

The government cites the testimony of its expert, Peter G. Wilhelm, who, when asked to compare the language of (e) with McLean, said: "[N]either Williams nor McLean fits the classical definition of a coordinate system, a fixed external coordinate system. But to the extent that the Williams apparatus can determine its position in . . . 'an external coordinate system', McLean does the equivalent. I see no difference in that." From that, the government says Williams and McLean each and to the same extent provide the indications recited in paragraph (e) of claim 1.

In *Hughes*, 640 F.2d at 1193, n. 1, 208 USPQ at 786, n. 1, the Court of Claims adopted most of the trial judge's findings. Adopted findings 33-62 (reproduced in *Hughes*, 640 F.2d at 1213-18, 208 USPQ at 803-07) establish that the Williams patent specification fully supports the claims, including the means recited in paragraph (e). Hence, Wilhelm's statement that Williams does not fit the claimed definition of a "fixed coordinate system" is erroneous.

Similarly, the government has not proven that McLean provides the recited indications, notwithstanding Wilhelm's indication to the contrary. The space vehicle of McLean maintains a collision course with a target, whereas the Williams satellite maintains its spin axis in an orientation parallel to the earth's spin axis while in synchronous orbit around the earth. The former, under internal control alone, automatically tracks a target, whereas the latter is controlled from the ground. Though both devices use a precessing jet on the periphery, pulsed synchronously with the spin cycle for changes in orientation, the differences in function lead to significant structural differences. Those differences are reflected in the claim language.

In arguing that McLean's space vehicle provides the indications recited in paragraph (e), the government assumes that the position of the vehicle's center would be known for any given instant of time, and that McLean's target is a known star. Neither assumption is warranted by McLean's disclosure. If the assumptions be made, we nonetheless detect no error in the finding that McLean does not provide an indication of the orientation of his spin axis with reference to a fixed external coordinate system, when a spin axis is out of alignment with the target star. Unlike Williams, such indication is unnecessary for McLean to accomplish precession. As government witness Wilhelm stated: "[McLean] only really had the angle between his spin axis and the target. But in his case, that's all the information that he needs. He doesn't really have to work in an external coordinate system. He's only trying to aim a line, a target."

The government's argument to the contrary notwithstanding, Hughes did not misinform the Patent

Office that the Williams V-beam sensor indicates spin axis orientation with reference to a fixed external coordinate system. As stated *supra*, findings made by the trial judge and adopted by the Court of Claims establish that Williams' disclosure of the V-beam sensor, coupled with the knowledge of one of ordinary skill in the art, supports the means recited in paragraph (e).

The government argues that the trial judge incorrectly interpreted McLean's teaching as restricted to a target-seeking vehicle in view of the McLean reissue patent (Re: 26,887, reissued May 19, 1970), broadly claiming a spin- stabilized vehicle under pulsed jet control. The argument is misplaced. McLean's *claims* added by reissue do broadly cover a spin-stabilized vehicle under pulsed jet control, but McLean's *disclosure* was not thereby changed. Whether Williams' claimed subject matter falls within the scope of McLean's reissue claims is irrelevant to the inquiry here under 35 U.S.C. § 103. There is nothing inconsistent with issuance of broad claims to McLean and narrower claims to Williams. We agree with the trial judge that, as a prior art teaching applicable here, "the disclosure of the McLean reissue adds nothing of significance to what was disclosed in the original McLean patent."

Having concluded that the subject matter of claims 1, 2, and 3 would have been nonobvious in view of the most pertinent prior art, the trial judge found it unnecessary to consider the "secondary considerations" referred to in *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 86 S. Ct. 684, 693-94, 15 L.Ed.2d 545 (1966). Hughes points to the: (1) government's unsuccessful efforts to solve the attitude control problem, despite

huge expenditures; (2) belief of experts that the problem could not be solved; (3) a long-felt need filled by the Williams invention; (4) commercial success; (5) government's protracted attempt to obtain title to the Williams patent; and (6) its admissions of non- obviousness during the title dispute. Those uncontested facts are additional evidence of nonobviousness, requiring no further discussion here.

Conclusion on Validity

We hold that the government has not proven the Williams patent invalid under 35 U.S.C. § 103.

II. Infringement

(A) *Literal Infringement*

In the "real-time" satellite disclosed by Williams, sun pulses (signals from the V-beam sun sensor) are transmitted to earth, enabling the ground crew to simulate the rotation of the satellite and to calculate the satellite's spin rate, sun angle, and ISA position, i.e., the measure of where the satellite is in its spin cycle at any instant of time. The sun pulses are known in "real time" and are used as reference points by the ground crew in transmitting firing signals to the jet, causing it to fire immediately and to produce precession.

In the accused S/E spacecraft, sun pulses are transmitted, but to a computer on board the spacecraft rather than to the ground. The computer calculates spin rate and transmits it to the ground. The computer also transmits sufficient information from which a ground crew can calculate the sun angle. With most S/E spacecraft, the ground crew does not know the spacecraft's ISA position. The ground crew does not need to know ISA position because the computer does and the ground crew knows the computer knows. With the IMP (H and

J) spacecraft, sufficient information to determine ISA position is transmitted to ground, but is used for analyzing data from scientific experiments, not for attitude control.

The sun pulses present on S/E spacecraft provide reference points for firing the jet to effect precession just as they do in the Williams invention, but after, not upon, receipt from earth of spaced firing signals: (1) an "information" signal telling the on-board computer when in each revolution the jet should be fired and how many firings (one per revolution) should be made; and (2) an "execute" signal telling the computer when to begin firing.

The trial judge correctly found, and it is here undisputed, that there are only two distinctions in the structure of the claimed Williams satellite from that of the S/E spacecraft. (1) the SKYNET II, NATO II, and DSCS II spacecraft do not include Williams' means for providing to the ground crew an indication of ISA position, having substituted computer-retention of that information; and (2) in all S/E systems, Williams' means for receiving synchronized control signals for immediate execution are substituted for by an on-board computer for receiving control signals and storing them for later execution. Because the claims speak of means for "providing an indication" of ISA position "to a location external" to the satellite, and to means for receiving from the external location firing signals "synchronized with said indication", there can be no literal infringement. At trial, Hughes conceded the absence of literal infringement and predicated its case for infringement on the doctrine of equivalents.

(B) *Doctrine of Equivalents and Doctrine of File Wrapper Estoppel*

The doctrine of equivalents comes into play only when actual literal infringement is not present. Under the doctrine of equivalents, an accused product that does not literally infringe a structural claim may yet be found an infringement "if it performs substantially the same function in substantially the same way to obtain the same result" as the claimed product or process. *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608, 70 S. Ct. 854, 856, 94 L.Ed. 1097 (1950) (quoting from *Sanitary Refrigerator Co. v. Winters*, 280 U.S. 30, 42, 50 S. Ct. 9, 13, 74 L.Ed. 147). The doctrine is judicially devised to do equity. "Courts have also recognized that to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing," *id.* 339 U.S. at 607, 70 S. Ct. at 856, and again, "The essence of the doctrine is that one may not practice a fraud on a patent," *id.* at 608, 70 S. Ct. at 856.

As summarized by the Supreme Court:

> Equivalence, in the patent law, is not the prisoner of a formula and is not an absolute to be considered in a vacuum. It does not require complete identity for every purpose and in every respect. In determining equivalents, things equal to the same thing may not be equal to each other and, by the same token, things for most purposes different may sometimes be equivalents.

Id. at 609, 70 S. Ct. at 856-57.

Hughes, having the burden of proving infringement by a preponderance of the evidence, *Roberts Dairy Co.*

v. United States, 530 F.2d 1342, 1357, 182 USPQ 218, 227 (Trial Div., Ct. Cl. 1974), *aff'd* 198 USPQ 383 (Ct. Cl. 1976), characterizes as "inconsequential" the differences in operation of the claimed invention and the accused S/E spacecraft. It asserts that the Williams satellite and S/E spacecraft are "obvious and exact equivalents". Hughes argues that: (1) though sun pulses are not sent to the ground by the SKYNET II, NATO II, or DSCS II spacecraft, they are retained in the on-board computer and used in the spacecraft for the same purpose as in Williams' "real-time" satellite, *i.e.*, as reference points to fire the precession jet; (2) respecting immediate and delayed firing, the Williams satellite and all S/E spacecraft require "synchronization of jet firing with spin position"; and (3) "[i]f there were doubt as to whether the S/E spacecraft are obvious and exact equivalents of Williams, the S/E spacecraft nevertheless fall within the broad range of equivalents to which the pioneer Williams patent is entitled."

Addressing the last argument first, we agree with the trial judge that Williams' invention is not of such "pioneer" status as to entitle the invention to the very broad range of equivalents to which pioneer inventions are normally entitled. McLean, not Williams, was the first to disclose the basic operational concept in which a pulsed jet is used to precess the spin axis of a spin-stabilized body. That does not mean, as discussed below, that the Williams invention is entitled to no range of equivalents. Nor is the Williams invention entitled only to that very narrow range of equivalents applicable to improvement patents in a crowded art.

Having chosen specific words of limitation to avoid the McLean disclosure, Hughes is estopped by the prosecution history of the application ("file wrapper

estoppel"), from obtaining a claim interpretation so broad as to encompass the McLean structure, or to encompass all structures in which a pulsed jet is used to precess the spin axis of a spin-stabilized body. The doctrine of prosecution history estoppel precludes a patent owner from obtaining a claim construction that would resurrect subject matter surrendered during prosecution of his patent application. The estoppel applies to claim amendments to overcome rejections based on prior art, *Dwyer v. United States*, 357 F.2d 978, 984, 149 USPQ 133, 138 (Ct. Cl. 1966), and to arguments submitted to obtain the patent, *Coleco Industries, Inc. v. ITC*, 573 F.2d 1247, 1257, 197 USPQ 472, 480 (Cust. & Pat. App. 1978). Williams did not, of course, surrender subject matter related to employment of an on-board computer to accomplish in a differently timed manner what is accomplished by his disclosed structure.

An applicant for patent is required to disclose the best mode then known to him for practicing his invention. 35 U.S.C. § 112. He is not required to predict all future developments which enable the practice of his invention in substantially the same way.

The trial judge correctly stated that Hughes is estopped from asserting that the elements of its claims "are unnecessary to avoid the art". The relevant consideration, however, is not whether the claims avoid the art but whether the accused S/E spacecraft are equivalents of the inventions set forth in the claims interpreted in light of the prior art. The government is not claiming that its S/E spacecraft are built and operated in accord with the prior art, or that it is merely following the teachings of McLean. If it had followed those teachings in constructing its S/E space-

craft, there is no question that the range of equivalents to which Williams' claimed invention is entitled could not be broad enough to encompass such spacecraft.

Some courts have expressed the view that virtually any amendment of the claims creates a "file wrapper estoppel" effective to bar all resort to the doctrine of equivalents, and to confine patentee "strictly to the letter of the limited claims granted," *Nationwide Chemical Corp. v. Wright*, 584 F.2d 714, 718-19 (5th Cir. 1978); *Ekco Products Co. v. Chicago Metallic Manufacturing Co.*, 347 F.2d 453, 455 (7th Cir. 1965). We, as has the Supreme Court, reject that view as a wooden application of estoppel, negating entirely the doctrine of equivalents and limiting determination of the infringement issue to consideration of *literal* infringement alone. That view, as above indicated, fails to recognize that the doctrine of equivalents is unnecessary when literal infringement is present and is contrary to the guidance provided by the Supreme Court in *Graver*, supra.

Amendment of claims is a common practice in prosecution of patent applications. No reason or warrant exists for limiting application of the doctrine of equivalents to those comparatively few claims allowed exactly as originally filed and never amended. Amendments may be of different types and may serve different functions. Depending on the nature and purpose of an amendment, it may have a limiting effect within a spectrum ranging from great to small to zero. The effect may or may not be fatal to application of a range of equivalents broad enough to encompass a particular accused product. It is not fatal to application of the doctrine itself.

We adhere to the view expressed by our predecessor court in *Autogiro Co. of America v. United States*, 384 F.2d 391, 155 USPQ 697 (Ct. Cl. 1967), and in *Garrett Corp. v. United States*, 422 F.2d-874, 164 USPQ 521 (Ct. Cl.), *cert. denied*, 400 U.S. 951, 91 S. Ct. 242, 27 L.Ed.2d 257 (1970). Discussing the relationship between the doctrines in *Autogiro*, the Court of Claims said:

> The doctrine of equivalence is subservient to file wrapper estoppel. It may not include within its range anything that would vitiate limitations expressed before the Patent Office. Thus a patent that has been severely limited to avoid the prior art will only have a small range between it and the point beyond which it violates file wrapper estoppel [Citations omitted].

384 F.2d at 400-01; 155 USPQ at 705.

Referring to the April 29, 1966 amendment described above, Hughes says: "All that Williams surrendered in order to avoid the prior art cited by the examiner were any claims that could be construed as applying to an automatic attitude control system not controllable from earth . . . [the] amendment did nothing but more accurately claim ground controllability as the point of novelty." We disagree. In that amendment, Williams did not submit claims broadly covering all ground controllable spacecraft, as he might have. Had he done so, and had such claims been allowed, literal infringement would have been present here. At the same time, Williams' amendment of the claims did not relate to any disclosure, in the prior art or elsewhere, in which the ISA position was stored in a computer along with command signals for later execution. Though we cannot agree that Williams' amendment left room for encompassing all ground-controlled spacecraft, it

remains true that the operation of the Williams and S/E spacecraft involve control input from a ground crew, and McLean does not. That is an important consideration in applying the doctrine of equivalents. It does not *alone* establish infringement under that doctrine.

Application of the Doctrine of Equivalents

The issue, as above indicated, is whether the accused S/E spacecraft infringe the claims under the doctrine of equivalents. That question turns on whether the S/E spacecraft employ substantially the same means which "perform substantially the same function" as that performed by the claimed invention, and do so "in substantially the same way" the claimed invention does, and "obtain the same result" as that obtained by the claimed invention.

In his opinion, exhaustive in respect of other issues, the trial judge treated the subject of equivalency in a single conclusory paragraph:

> There is no obvious or exact equivalent of plaintiff's means for providing an indication of the ISA to an external location in either of the SKYNET II, NATO II or DSCS II systems. Nor is there an obvious or exact equivalent of the means for pulsing the precession jet within a fixed time period after the receipt of a control signal in any of the accused store and execute systems.

The trial judge declined to supply reasoning in support of that conclusion and did not apply the "substantially the same function, in substantially the same way, to obtain the same result" guidance set forth in *Graver*, supra. He also declined, as have the parties here, the opportunity to define "obvious or exact equivalent". That phrase is not defined, moreover, in

the case on which he relied, *Eastern Rotorcraft Corp. v. United States*, 397 F.2d 978, 982, 154 USPQ 43, 46 (Trial Div., Ct. Cl. 1967), *aff'd* 158 USPQ 294 (Ct.Cl.1968), or in the case cited therein, *Southern Textile Machinery Co. v. United Hosiery Mills Corp.*, 33 F.2d 862, 866, 2 USPQ 183, 186 (6th Cir. 1929). Neither the trial judge nor the government, for example, has explained why employment of the now-well-known store and execute capabilities of a computer was not an employment of substantially the same means or an "obvious" equivalent, or why the performance thereby of the functions of the Williams' claimed elements did not render the S/E spacecraft "exact" equivalents.

However the phrase "obvious and exact equivalents" may be defined, it was effectively and improperly applied here as a substitute for literal infringement, the absence of which was conceded. The failure to apply the doctrine of equivalents to the claimed invention as a whole, and the accompanying demand for "obvious and exact" equivalents of two elements the presence of which would have effectively produced literal infringement, was error.

In *Eastern Rotorcraft*, the Court of Claims afforded the patentee a limited application of the doctrine of equivalents, concluding that the range of equivalents of the claimed invention there encompassed the accused device. We hold that the trial judge erred as a matter of law in not so interpreting the scope of Williams' claims 1, 2, and 3 in their entirety, and in applying an appropriate range of equivalents to the entirety of the accused S/E spacecraft.

There are striking overall similarities between Williams' claimed satellite and the S/E spacecraft: (1) each is spin-stabilized; (2) each contains a jet on the

periphery, connected by a valve to a tank containing fluid for expulsion substantially parallel to the spin axis; (3) each employs sun sensors to sense ISA position; (4) each requires knowledge of orientation relative to a fixed external coordinate system; (5) each contains radio equipment for communicating with the ground; (6) each transmits spin rate and sun angle information to a ground crew; and (7) in each, jet firing is synchronized with ISA position to effect controlled precession and thus to achieve a desired orientation. Only elements (1) and (2) are found in McLean. Clearly, the S/E spacecraft are much closer to Williams' satellite than they are to McLean's space vehicle. It is clear also that, in constructing its S/E spacecraft, the government followed the teachings of Williams much more than it did those of McLean. In following Williams' teachings, the government merely employed a modern day computer to do indirectly what Williams taught it to do directly.

The dispute as presented centers on what appears in paragraphs (e), (f), and (g), of representative claim 1:

> e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;
>
> f. and means disposed on said body for receiving from said location control signals synchronized with said indication;
>
> g. said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to

orient said axis in a predetermined desired relationship with said fixed external coordinate system.

Paragraph (e) "providing an indication"

Based on the testimony of its expert, Arthur E. Bryson, Jr., Hughes argues that the S/E spacecraft, with the ISA position indication retained on-board, are equivalents of Williams' claimed satellite, with the ISA position indication sent to ground, performance of the function involving the ISA position being substantially the same in each. We agree. Once an on-board computer became available, as Bryson said, "any intelligent engineer designing this [S/E] system would say 'Look, I don't need to send the value of that ISA position to the ground, it's right there in the spacecraft. I'll just key my firing signal to that on board the spacecraft'."

The S/E spacecraft are identical with the Williams satellite, except for the employment of sophisticated, post-Williams equipment (computers) to achieve attitude control in the basic manner taught by Williams. Advanced computers and digital communications techniques developed since Williams permit doing on-board a part of what Williams taught as done on the ground. As one of our predecessor courts, the Court of Claims, has thrice made clear, that partial variation in technique, an embellishment made possible by post-Williams technology, does not allow the accused spacecraft to escape the "web of infringement". *Bendix Corp. v. United States*, 600 F.2d 1364, 1382, 204 USPQ 617, 631 (Ct. Cl. 1979); *see Decca Ltd. v. United States*, 544 F.2d 1070, 1080-81, 191 USPQ 439, 447-48 (Ct. Cl. 1976); *Eastern Rotorcraft Corp. v. United States*, 397 F.2d at 981, 154 USPQ at 45.

That an appropriate range of equivalents of the claims extends beyond devices that send the ISA position indication to ground is consistent with Williams' patent specification:

> As an example of one means of controlling the starting time and duration of pulses to the jet control valves . . . in such a way as to result in thrust during the correct portion of each spin revolution, cam-controlled contacts or switches may be used.

In the operation of the S/E spacecraft, the information that is transmitted to the ground crew, to enable them to determine and provide thrust during "the correct portion of each spin revolution", is the modern-day equivalent of sending the ISA position indication to the ground for that same purpose in Williams. Put another way, retention of the ISA position in an on-board computer, while transmitting sufficient information to enable the ground crew to use that computer-retained information to control the satellite, is the modern-day equivalent of providing an indication of ISA to ground as taught by Williams.

The government asserts only that its S/E spacecraft do not send an indication of the ISA position to the ground. That argument is clearly effective against an allegation of literal infringement, for if the S/E spacecraft *did* send an ISA position to the ground, literal infringement of that element of the claims would be clear. Williams controls his satellite, and the government controls its S/E spacecraft, from the ground. That Williams does so in "real time" and the government does so in a delayed reaction made possible by the advent of computers does not establish that the S/E

spacecraft do not perform the same function in substantially the same way to obtain the same result.

Paragraphs (f) & (g) "direct" vs. "indirect" firing

The distinction emphasized by the government between "direct" firing and its own "indirect" firing, phrased also as a distinction between "external" and "internal" synchronization of command signals with ISA position, and as a distinction between firing in "fixed" time and in "computer-set" time, rests on the government's use of modern memory circuits on-board S/E spacecraft to store commands for later use. As above indicated, mere substitution of an embellishment made possible by post-Williams technology does not avoid infringement. *See Bendix Corp., Decca Ltd., and Eastern Rotorcraft, supra.* Applying the guidance of those cases, along with that in *Graver*, supra, the range of equivalents of the present claims reaches the S/E spacecraft, wherein sun pulses, though retained on-board, are derived and used in the same way as in Williams to perform the same function, jet firing, which, though "indirect", is synchronized with ISA position precisely as taught by Williams.

The S/E spacecraft and the Williams claimed satellite each have on-board means for transmitting to ground the sun angle and spin rate. In each, the ground crew determines: (1) present orientation; (2) desired orientation; and (3) where in the spin cycle and how many times the jet must be pulsed to change (1) to (2). Each system, furthermore, provides for receipt of command signals to cause firing of the precession jet. The S/E spacecraft uses sun pulses retained on-board as reference points to fire the jet. Williams uses sun pulses sent to ground as reference points to fire the jet. The difference between operation by retention and opera-

tion by sending is achieved by relocating the function, making no change in the function performed, or in the basic manner of operation, or in the result obtained.

Conclusion on Equivalents

The S/E spacecraft and the claimed Williams satellite reflect the precise circumstance envisaged in *Graver, supra*, for they perform the same function (receipt of and response to command signals from an external location to accomplish precession), in substantially the same way (jet firings synchronized, albeit later and internally, with ISA position) to obtain substantially the same result (controlled precession of spin axis in a predetermined direction to orient a hovering satellite). At the same time, neither resembles as closely the self-guiding space vehicle of McLean or its purely automatic operation.

Accordingly, we hold that Hughes has proven that the government's S/E spacecraft infringe Williams' claims 1, 2, and 3 under the doctrine of equivalents.

DECISION

The holding that the Williams patent is valid is affirmed. The finding that the claims are not infringed by certain of the accused S/E spacecraft is reversed. The case is remanded for determination of the quantum of recovery due Hughes for infringement by the accused SKYNET II, NATO II, DSCS II, IMP (H and J), SOLRAD (9 and 10), and PIONEER (10 and 11) spacecraft.

AFFIRMED-IN-PART, REVERSED-IN-PART, AND REMANDED.

DAVIS, Circuit Judge, concurring in part and dissenting in part.

I join the court's opinion except for the discussion of, and decision on, infringement by the S/E spacecraft through the doctrine of equivalents. On the latter issue, on which I dissent, I agree with Judge Colaianni that the S/E satellites do not infringe the Williams patent. I would therefore affirm all of his decision.

My difference with the majority is that I would hold the doctrine of equivalents inapplicable to the S/E spacecraft involved here because, to find equivalence as the majority does, that doctrine has to be stretched far too broadly for the Williams patent.

1. The status and history of the patent is very important. I agree with the majority that Williams is not a pioneer patent; accordingly, it is not entitled to the broad range of equivalents allowable for pioneer inventions. In addition, the prosecution history shows that, after the citation of McLean, the Williams inventors cancelled several of their original, broad claims and substituted new claims (now claims 1-3) containing new limiting elements directly relevant to the charge of infringement by the S/E satellites: (1) means for providing an indication of ISA to an external location; and (2) means for applying fluid to fluid expulsion means within a fixed time period after the receipt of a control signal from the external location.

The accused S/E spacecraft do not contain those elements which were expressly included to overcome prior art.[1] As the majority says, these new claims show that Williams did not submit claims broadly covering all ground controllable spacecraft. An infringing article must embody the two elements I have mentioned, either literally or through an appropriate equivalent. Those elements show the invention which was patented in this Williams patent.

2. In the light of Williams' non-pioneer status and of this prosecution history I cannot accede to the majority's entire dispensation (with respect to three of the S/E spacecraft) of the specific element of "means * * * providing an indication" to a specific external location of the ISA. As the trial judge put it, this part of the claims (and the relevant claims as a whole) expressly call for a structure on the spinning body which is limited "to an altitude control system wherein a ground controller is needed to determine the ISA * * * *."

It is clear, however, that these three accused satellites—SKYNET II, NATO II and DSCS II—do not provide any indication whatever of ISA to the earth (or any other external source). Moreover, the ground personnel have absolutely no need to know the ISA position, do not know it, and cannot determine it. The calculations involving ISA are wholly done by an on-board computer and are available only there. To find, as the majority does, in this self-contained on-board computer an equivalent of the specific require-

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[1] SKYNET II, NATO II and DSCS II do not have either means; none of the accused S/E spacecraft (including the three just mentioned plus IMP (H and J)) has the second means.

ment for providing an indication of ISA to the ground (so that the ground can take account of ISA) is simply to obliterate and disregard this element of the claims. These accused structures may possibly obtain "the same result" as Williams but they do not perform "the same function" in "the same way" either literally or substantially. Whether or not this on-board device for calculation would be unobvious—and there is no finding and (to my mind) no showing that it would have been obvious—its substitution was not a proper equivalent for infringement of this non-pioneer patent because the wholly on-board computer device operated in a different way to perform the different function of a significant calculation unrelated to ground personnel.[2] Unlike the Court of Claims decisions cited in the court's opinion this is not the case of a "sophisticated" technique of performing the same function in the same way. It is a "sophisticated" method of performing a different function in a different way. Even if the standard of "obvious and exact equivalents" (*Eastern Rotorcraft Corp. v. United States*, 397 F.2d 978, 982, 154 USPQ 43, 46, 158 USPQ 294 (Ct. Cl. 1968)) is considered as too narrow, the accused devices here are definitely outside the equivalence principle of *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608, 70 S. Ct. 854, 856, 94 L.Ed. 1097 (1950).

3. The same is true of the elements specifying the method for controlling the precession jet. In this regard, Williams, again as Judge Colaianni points out, limits its claims so as to require a ground controller, not

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[2] The majority quotes Hughes' expert as testifying that it would have been obvious to place the calculating device on the spacecraft but the Government's witnesses testified that this device was not an equivalent.

only to determine the ISA, but also to use the ISA to pulse the precession jet during the desired portion of the spin cycle. As to the latter, the claims in suit also require means for pulsing the precession jet within a fixed time period after the receipt of the control signal. This does not occur in any of the accused structures, nor does the ground location use ISA to determine the execute command.[3]

As with the other Williams element ("providing an indication" of ISA) discussed *supra*, the elements pertaining to "firing" or "execution" cannot properly be deemed equivalents of the pertinent Williams elements. The gist of Williams was that this function was to be performed primarily by the ground location acting externally to the spacecraft on the basis of an indication of ISA transmitted to that location.[4] The S/E spacecraft, on the contrary, utilizes an on-board computer and command storage means for receiving and storing a

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[3] The trial judge put it: "[Hughes] admits that in Williams the jet is activated directly upon receipt of the control signal while in the store and execute systems the command signal is first stored and verified. The later execute signal in the store and execute systems sets the original command into action but there is no fixed time interval between the receipt of the execute signal and the firing of the precession jet. No command signal is synchronized with the ISA. There is no structure on the store and execute spacecraft which acts to pulse the precession jet within a fixed time period after the receipt of a control signal." In Williams, on the other hand, "[in] order to permit the ground control to pulse the precession jet during the proper portion of the open cycle, there must be a known fixed time period between the receipt of a control signal and the activation of the precession jet."

[4] I have already indicated, *supra*, that in my view the prosecution history reflects strong emphasis by the applicants on control through an external location. The trial judge has also taken that position.

different type of control signal (as well as also using on-board ISA data); ground personnel have only a limited, secondary role and do not take account of ISA. Moreover, in Williams there must be a fixed time period between the receipt by the spacecraft of a control signal and the activation of the precession jet. In the S/E satellites, in contrast, neither the ground nor the execute signal operates to activate the precession jet within a fixed time period (instead, that period varies). The sum of it is that the S/E structures perform a "different function" in a "different way" from those claimed by Williams—and are therefore not within the *Graver* principle.

4. The result, as I see it, is that the doctrine of equivalents cannot be employed in this case without taking an impermissible quantum leap outside the perimeters of that principle as it should be applied to the Williams patent.

APPENDIX D

UNITED STATES COURT OF FEDERAL CLAIMS

No. 426-73

HUGHES AIRCRAFT COMPANY, PLAINTIFF

v.

UNITED STATES OF AMERICA, DEFENDANT

June 17, 1994

OPINION ON DAMAGES

TURNER, Judge.

Hughes Aircraft Company owns U.S. Patent No. 3,758,051, entitled "Velocity Control and Orientation of a Spin-Stabilized Body," which describes an apparatus for controlling the attitude of a spin-stabilized spacecraft. The patent was issued to Hughes on September 11, 1973, as assignee of inventor and former Hughes employee, Donald D. Williams. The patent, commonly referred to as the Williams patent, expired on September 11, 1990.

I

Hughes brought this action pursuant to 28 U.S.C. § 1498, seeking just compensation for the unlicensed use or manufacture by or for the government of

spacecraft containing an embodiment of the patented apparatus.

Hughes filed its complaint on November 13, 1973. A description of the course of this litigation, including appeals of trial court determinations, is set forth in an Opinion on Liability dated August 16, 1993, 29 Fed. Cl. 197, 201- 02. It will suffice for present purposes to recite that over the course of this litigation, a total of 108 spacecraft have been accused and that a determination of eligibility for just compensation has been made with respect to 81 spacecraft.[1] An Opinion on Compensation Base, filed April 29, 1994, resolved all then-remaining valuation issues pertaining to the 81 spacecraft and set forth a schedule of values and royalty payment dates for computation of damages.

This opinion addresses all remaining issues in the case, to wit, the damages issues pertaining to royalty rate and delay damages.[2]

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[1] The appendix to the Opinion on Liability, 29 Fed. Cl. at 243-48, lists each of the 108 spacecraft accused during any stage of this litigation and sets forth, with references, the liability ruling with respect to each one. Appendix B to the Opinion on Compensation Base, dated April 29, 1994, lists the 81 spacecraft with respect to which liability has been determined and sets forth the precise royalty payment dates and valuations with respect to each.

[2] See *Hughes Aircraft Co. v. United States*, 15 Cl. Ct. 550, 551 n. 2 (1988), for a list of previously published opinions in this case and other cases involving the Williams patent. Two additional published opinions in this case are the Opinion on Liability, 29 Fed.Cl. 197 (1993) and the Opinion on Compensation Base, dated April 29, 1994. The instant opinion is the 16th published opinion directly involving the Williams patent.

II

Any determination of damages in patent litigation against the government must begin with contemplation of 28 U.S.C. § 1498(a):

> Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his *reasonable and entire compensation for such use and manufacture.*

(Emphasis added.) Pursuant to this statute, in the context of this litigation, the focus shifts to a determination of the royalty rate and delay damages method which will provide to plaintiff "reasonable and entire compensation" for the government's use of the Williams invention in each of the 81 infringing spacecraft.

Section 1498 does not instruct a court on how to compute damages: the only congressional intent expressed ensures that a claimant receive "reasonable and entire compensation." "The size of an award is left to the trial court's sound discretion." *Paper Converting Machine Co. v. Magna-Graphics Corp.*, 745 F.2d 11, 21 (Fed. Cir. 1984) (construing analogous provisions of 35 U.S.C. § 284).

III

A

Among several methods employed by courts for determining reasonable compensation for patent use, the preferred method, and the one most frequently

employed, is determination of a reasonable royalty. *Decca, Ltd. v. United States*, 225 Ct. Cl. 326, 336-345, 640 F.2d 1156, 1167-72 (1980), *cert. denied*, 454 U.S. 819, 102 S. Ct. 99, 70 L.Ed.2d 89 (1981). In this case, the parties agree that determination of a reasonable royalty is the appropriate first step in the calculation of compensation; thus, there is no occasion to address other methods. [3]

The legal principles controlling determination of royalty rates are ably set forth in *Penda Corp. v. United States*, 29 Fed. Cl. 533, 573-74 (1993)[4] and in *ITT*

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[3] Other damages calculation methods applied in patent litigation against the government are described in *Decca*, 225 Ct. Cl. at 336-37, 640 F.2d at 1167-68; *Leesona Corp. v. United States*, 220 Ct. Cl. 234, 255-57, 599 F.2d 958, 968-71 (1979); *Tektronix, Inc. v. United States*, 213 Ct. Cl. 257, 268-69, 552 F.2d 343, 349 (1977), *reh'g denied*, 216 Ct. Cl. 144, 575 F.2d 832, *cert. denied sub nom. Hickok Elec. Instr. Co. v. Tektronix, Inc.*, 439 U.S. 1048, 99 S. Ct. 724, 58 L.Ed.2d 707 (1978); *Penda Corp. v. United States*, 29 Fed. Cl. 533, 573 (1993). These methods include patentee's lost profits and savings to the government.

[4] *Penda*, 29 Fed. Cl. at 573, sets forth the following general principles pertaining to "reasonable and entire compensation" under 28 U.S.C. § 1498:

> The government may take a license in any United States patent. The patentee's sole remedy is a suit in this court for its "reasonable and entire compensation" under section 1498. This remedy is premised on a theory of eminent domain. The property interest taken by the government is a compulsory, compensable, nonexclusive license.
>
> The "reasonable and entire compensation" owed the patent holder is equivalent to just compensation under the fifth amendment. Thus, the court has traditionally turned to the law of eminent domain for legal precedents to apply in determining "reasonable and entire compensation." *Basic principles of fairness are the governing consideration in determin-*

Corp. v. United States, 17 Cl. Ct. 199, 202, 223 (1989), and do not require repetitive explication. In short, the controlling precepts applicable here are that (1) if there was an established royalty applicable to the patent-in-suit, that rate will usually be adopted as the best measure of reasonable compensation and (2) if there is no established royalty, the rate will typically be determined through a process of hypothetical negotiation between a suppositious "willing buyer" and "willing seller" as of the date of initial infringement but using knowledge of events which occurred after the initial infringement and which, thus, could not have been known by actual negotiators as of that date.[5]

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ing just compensation for an eminent domain taking. These same principles guide in assessing reasonable and entire compensation.

(citations omitted) (emphasis added).

[5] A full explanation of the "willing buyer-willing seller" rule is set forth in *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116, 1121-22 (S.D.N.Y. 1970), *modified and affirmed*, 446 F.2d 295 (2d Cir.), *cert. denied*, 404 U.S. 870, 92 S. Ct. 105, 30 L.Ed.2d 114 (1971).

The Second Circuit, in its review of the district court opinion just cited, stated: "We realize that no one can be sure what the parties would have done had they actually negotiated. But determination of an assumed reasonable royalty is in essence a device for retroactively reaching a just result. . . ." *Georgia-Pacific Corp. v. U.S. Plywood-Champion Papers, Inc.*, 446 F.2d 295, 300 (2d Cir. 1971). The court then quoted with approval an opinion by Judge Learned Hand: "The whole notion of a reasonable royalty is a device in aid of justice, by which that which is really incalculable shall be approximated. . . ." *Id.* n. 5 (quoting *Cincinnati Car Co. v. New York Rapid Transit Corp.*, 66 F.2d 592, 595 (2d Cir.1933)).

B

In the instant case, there plainly was no established royalty rate or other royalty compensation formula for the Williams patent. The parties concur on this threshold factor (Tr. 18,227). In fact, after the patent issued in September 1973, there was never a license agreement with anyone pertaining to its use (with the sole exception of a general, nonexclusive license pertaining to future use as part of a major settlement of past infringement, *see Hughes Aircraft Co. v. United States*, 15 Cl. Ct. 550, 552-53 (1988)), despite plaintiff's efforts to enter licensing agreements with at least three major spacecraft manufacturing firms.

Given the absence of an established royalty, the focus shifts to determination of a reasonable royalty rate by a consideration of the factors which would have influenced reasonable businessmen resolved to enter a mutually agreeable licensing arrangement.

There is no fixed formula for calculation of a reasonable royalty. "The [willing buyer-willing seller] rule is more a statement of approach than a tool of analysis." *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. 1116, 1121-22 (S.D.N.Y. 1970), *modified and affirmed*, 446 F.2d 295 (2d Cir.), *cert. denied*, 404 U.S. 870, 92 S. Ct. 105, 30 L.Ed.2d 114 (1971). Essentially, the rule suggests a process for evaluation of all relevant factors which knowledgeable, prudent businessmen would likely consider as having a bearing on an appropriate royalty rate.[6]

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[6] Among items considered by such suppositious negotiators are those set forth in *Georgia-Pacific Corp.*, 318 F. Supp. at 1120. Although originally presented as a list of "some" of the factors "seemingly more pertinent to the issue" in that particular case, 318

The parties agree in principle that on the facts of this case the appropriate method for fashioning a reasonable royalty is to select a percentage of total spacecraft cost as the royalty with respect to each infringing vehicle. The parties further agree that it is appropriate to select a single rate to apply to every infringing spacecraft no matter when during the patent term the unlicensed use occurred and regardless of the extent of use.[7] Thus, the sole remaining issue concerning the basic royalty for each infringing use is the rate expressed as a percentage of cost.

C

To state the obvious, a royalty rate has significance only in relation to the base to which it is applied. Here, the parties agree that the royalty rate, however determined, is for application to the total cost of each infringing spacecraft,[8] not merely to the relatively

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F. Supp. at 1120, the 15 "Georgia-Pacific factors" have become enshrined in case law as *the* definitive criteria for determination of a reasonable royalty. *See, e.g., Tektronix*, 213 Ct. Cl. at 268-69, 552 F.2d at 349; *Penda*, 29 Fed. Cl. at 573-74; ITT, 17 Cl. Ct. at 202, 223.

The factors considered significant in this case are discussed in text. Although the "amount" arrived at through hypothetical negotiation is listed as the 15th and last factor in *Georgia-Pacific Corp.*, 318 F. Supp. at 1120, it essentially subsumes all of the first 14 factors.

[7] A potential, more complicated alternative to a single royalty rate applicable to the total cost of each infringing spacecraft would be two or more rates to apply depending on whether a particular space vehicle used Williams as the primary attitude control system or merely as a backup or whether Williams was used only in the transfer orbit rather than throughout the life of the space mission.

[8] The term "total spacecraft cost" in this litigation is understood to mean the total procurement cost to the government for an

minor costs of the components which make up the attitude control system on each vehicle. As stated by plaintiff in correspondence with a potential licensee, "If the royalty base were reduced, the royalty rates would be higher" (DX 2081 at 3).

D

Application for the Williams patent was filed in April 1960. During the 1960's, Hughes demonstrated the worth and reliability of the Williams technology on the SYNCOM and INTELSAT communications satellites. (For a more complete description of this early development, see *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1352-54 (Fed.Cir.1983).) Throughout the 1960's and early 1970's, a number of spacecraft were built by others and successfully launched using the Williams technology (including all those in the compensation base having a royalty payment date of September 11, 1973). The patent finally issued, after a prolonged challenge by the United States, in September 1973. Thus, as of that time, Hughes had a domestic 17-year monopoly (save for use by or for the United States) over a proven, desirable attitude control system. By then the space industry was a booming one with prospects for exponential growth (Pl.Br. (7/25/89) at 10-54). This was the context for Hughes' contacts with three major aerospace firms over the period from 1974 to 1978 in an effort to license the Williams patent

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airborne (or prototype, qualification test) vehicle including the total cost of the design, fabrication and testing of the spacecraft, the cost of government furnished equipment aboard the spacecraft and the cost of payload, as well as the cost of launch support and initial orbital support services customarily performed by an aerospace contractor and the value of performance incentives and awards.

(together with the dominating McLean patent, *see* 717 F.2d at 1362).

By letter of July 15, 1974, Hughes' director of domestic patent licensing corresponded with Philco-Ford Corp. (later renamed Ford Aerospace and Communications Corp.) (DX 2047). The letter offered to license both the Williams and McLean patents[9] for five percent, or either separately for three percent, of "the sales price of the satellite calculated at the time it is delivered to the launch pad." The July 15 letter concerning royalty rates was in response to a Philco-Ford letter dated January 8, 1974 requesting Hughes to advise if it had "licensed others under these patents [i.e., Williams and McLean], or have established a proposed royalty under these two patents" (DX 2074) and further in response to a Philco-Ford letter dated June 19, 1974 stating that it continued to be interested in knowing the "terms and conditions" upon which Hughes was "prepared to grant licenses" under the Williams and McLean patents (DX 2076).

Although at the time of the July 15, 1974 letter there was pending a suit by Hughes against Philco-Ford for alleged infringement of the Williams patent, there is nothing in the July 15 letter to suggest that the license terms were proposed merely in settlement of that litigation. Indeed, an exchange of correspondence between the two aerospace companies makes it plain that Philco-Ford was inquiring about and Hughes was

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[9] For a description of both the Williams and McLean patents and their relationship with each other, see *Hughes Aircraft Co.*, 717 F.2d at 1353- 56. By the time Hughes acquired the right to license both Williams and McLean in September 1973, the United States had independently acquired a non-exclusive license to use the McLean patent.

responding concerning whether it had decided upon a proposed royalty (the patent term had only recently commenced) and the terms upon which a license may have been offered to others unrelated to their pending patent dispute (DX 2073 through DX 2076, DX 2047, DX 2078).

Philco-Ford never responded to the July 15, 1974 proposal of royalty terms. Presumably the offer stayed open until March 23, 1976 when it was expressly withdrawn by letter (DX 2078).

By letter of September 16, 1974, approximately two months after the July 15 offer to Philco-Ford and approximately one year into the patent period, Hughes made an identical offer to TRW, Inc., another major aerospace competitor (PX 1375-18 at D40653). There was not then and never has been at any relevant time any litigation or threat of litigation between Hughes and TRW pertaining to the Williams patent. TRW never responded to the proposal; presumably the offer stayed open until March 26, 1976 when it was expressly withdrawn by letter (PX 1375-18 at D40654).

It is important to note that the royalty rate (three percent for use of Williams alone) offered by Hughes to two of its major domestic competitors early in the patent term was made with respect to a base that would not include government furnished equipment (rather only the sales price moving to the licensee) and would not include the value of any launch and orbital support services or the value of any post-launch incentive awards based on spacecraft performance. Consequently, the three percent royalty suggested in the letter for Williams alone, if adjusted for application to a base consisting of "total spacecraft cost" as used in this case, would be significantly smaller. (At all times

material in this litigation, the government has enjoyed the right to use the McLean patent, the other patent mentioned in the letters.)

By letter of May 2, 1978, less than five years into the patent period, Hughes proposed licensing terms for the Williams and McLean patents to the German aerospace firm of Messerschmitt-Bolkow-Blohm (MBB), a major European competitor (DX 2081). The letter was part of a series of communications in connection with settlement of claims Hughes was asserting against MBB, *see* DX 2080, and consequently for the most part cannot fairly be considered an ordinary proposal of licensing terms. However, in the course of the letter, at pages 2-3, Hughes indicated that its "normal royalty rate" for licensing both Williams and McLean was five percent of "full contract price" of a commercial spacecraft or two percent of the "full contract price" of scientific or experimental spacecraft "except that in the case of scientific and experimental spacecraft we would exclude the cost of the scientific or experimental payloads provided to MBB by others."

The May 2, 1978 letter to MBB demonstrates that less than five years into the patent term Hughes was characterizing as its "normal royalty rate" for use of both Williams and McLean in scientific or experimental space vehicles two percent of a base significantly less than "total spacecraft cost" as defined in the instant case. It is reasonable to infer that Hughes was then willing to license Williams alone for use on scientific or experimental space vehicles for 1.2 percent (i.e., 60 percent of two percent, the same proportion of the rate for two patents twice proposed to competitors in 1974 as the rate for either patent separately) of a base consisting of total spacecraft cost less the value of

scientific or experimental payloads not fabricated by a competitor licensee.

All of the 81 spacecraft found to infringe in this case would meet the description of "scientific or experimental space vehicles" designated by Hughes in connection with its "normal royalty rate." Thus, it is reasonable to infer that Hughes was then willing to license Williams alone for a rate significantly less than 1.2 percent of "total spacecraft cost" as defined in this case for use on the kind of vehicles found to infringe.

E

Plaintiff has suggested that because the rates proposed to Philco-Ford in 1974 and the "normal royalty rates" related to MBB in 1978 were communicated when litigation over the Williams patent was pending with each prospective licensee, the communications constitute "statements made in compromise negotiations" and are consequently inadmissible in light of Rule 408 of the Federal Rules of Evidence. However, Rule 408 provides:

> This rule does not require the exclusion of any evidence otherwise discoverable merely because it is presented in the course of compromise negotiations. This rule also does not require exclusion when the evidence is offered for another purpose . . . [i.e., other than to prove liability for or invalidity of a claim or its amount].

Here, Hughes' determination of and statements concerning its normal royalty rates available to competitors early in the patent term whether or not litigation was pending or infringement was suspected are "otherwise discoverable." Further, evidence of Hughes' representations concerning its normal royalty

rates are not offered in the instant case to prove anything concerning its infringement claims against Philco-Ford or MBB but rather "for another purpose." Thus, statements pertaining to Hughes' own valuation of the patent contained in the above-cited letters to Philco-Ford and MBB meet the criteria of both the "otherwise discoverable" and "another purpose" exceptions and are not rendered inadmissible by the provisions of Rule 408.[10] Of course, Rule 408 has no possible application to the offer made to TRW, Inc. (identical in all respects to the offer made to Philco-Ford) since Hughes was not then asserting any claims against TRW pertaining to Williams.

F

These actual, historical licensing offers pertaining to the Williams patent are highly significant in two respects. First, they have the effect of placing a ceiling on the consideration of a royalty rate. In *Pitcairn v. United States*, 212 Ct.Cl. 168, 186, 547 F.2d 1106, 1118 (1976), *cert. denied*, 434 U.S. 1051, 98 S. Ct. 903, 54 L.Ed.2d 804 (1978), the Court of Claims stated: "[T]here is no reason why the [patent] owner himself should not be held to his own offer[s]. . . . It is appropriate to take them into account and to give them great weight." One of the patent valuation witnesses called by the plaintiff, George E. Frost, stated in an article entitled "Accountings" (DX 2109 at 115; also found at George E. Frost, *Accountings*, 15 INTELL. PROP.L. REV. 107 (1983)): "The patentee's actions in

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[10] Rule 102 of the Federal Rules of Evidence provides: "These rules shall be construed to secure fairness in administration . . . and promotion of growth and development of the law of evidence to the end that the truth may be ascertained and proceedings justly determined."

granting licenses can be a prime factor in determining the reasonable royalty. . . . *License offers made to the trade and rejected by all can fix the ceiling below which the reasonable royalty must fall.* . . ." (Emphasis added.) Based on this logical concept, hypothetical negotiators for the parties, presumed to have knowledge of all relevant facts even though occurring after the date of initial infringement, would start with the rate offered by Hughes for scientific and experimental spacecraft like the 81 found to infringe in this case. As discussed above, this starting rate would likely be something less than 1.2 percent of "total spacecraft cost" which includes the value of all payload furnished by the government.

The second significant fact concerning the offers actually made by Hughes early in the patent term is that there were no takers at this "ceiling" rate despite the proven utility and reliability of the invention. (See *Hughes Aircraft Co.*, 717 F.2d at 1352-53, for description of the need for and usefulness of the technology). Hughes was entirely unsuccessful in licensing the Williams patent. During the full 17-year patent period, not one aerospace company entered a license agreement with Hughes (with the exception of the prospective license granted to Ford Aerospace and Communications Corp. as part of a general release of infringement claims and a mutual exchange of patent rights, *see Hughes Aircraft Co.*, 15 Cl.Ct. at 552, which was included as part of a lump-sum settlement amount and not related to a percentage of the cost of future uses). This means that a royalty arrived at through the hypothetical negotiation process must fall below the universally rejected level of the offers made by Hughes at the time of its greatest value. Of course, in this case

the rate cannot fall below one percent of total spacecraft cost since even the government acknowledges that a royalty at that level is reasonable.

A negotiation which starts with a ceiling of something significantly less than 1.2 percent, which will end at a rate less than the starting point and which will not fall below one percent will quickly settle on one percent. Support for a royalty rate of one percent of total spacecraft cost is furnished by a consideration of the other factors which hypothetical negotiators would deem relevant.

G

1

It is axiomatic that the larger the potential compensation base to which a royalty rate will be applied, the lower will be the rate. Here, the actual base to which a royalty will be applied has been determined to exceed $3.5 billion dollars. This sum is the value of the 81 spacecraft found to infringe; Hughes accused an additional 27 spacecraft during the course of this litigation.

Hypothetical negotiators in 1973 would see a number of successful aerospace companies, both American and European, as well as both a civilian and a military space agency within the federal government, in a position to design the proven Williams invention into their spacecraft, either as the primary, transition or backup attitude control system, and thus contribute to a large royalty base. Such negotiators are presumed to have knowledge of the Federal Circuit's 1983 ruling that "store-and-execute" spacecraft which otherwise literally use the Williams process would be found to infringe

under the doctrine of equivalents, 717 F.2d at 1363-66, thus vastly expanding the potential compensation base.

Further, the hypothetical negotiators would anticipate the exponential growth in the dollar value of spacecraft over the patent term, would realize that they were negotiating with respect to total spacecraft cost, which includes the value of payload, the cost of launch support and orbital support services and the value of post launch incentives and awards, and would realize that the royalty would be applied to all vehicles which employ the patent even if not successfully launched and even if the patent was used on a qualification test vehicle which was never intended for launch.

2

The Williams invention was not a "pioneer" invention, i.e., one covering a function never performed before, 717 F.2d at 1362; rather the patent was of the "improvement" type and was dominated by the McLean patent. McLean was the pioneer patent concerning controlled precession of a spin-stabilized body by use of a pulsed jet, *id.*, and the government, as of 1973, already had a non-exclusive license to use McLean. Although the absence of "pioneer" status in no way denigrates the undeniable desirability and utility of Williams, it is a factor which would likely cause negotiators to settle upon a rate lower than if the patent had pioneer status.

3

The license taken by the government as the result of use compensable under 28 U.S.C. § 1498 was a non-exclusive license. Hughes remained free to exploit the patent to the maximum with other customers, e.g., International Telecommunications Satellite Organiza-

tion (Intelsat), and to negotiate non-exclusive licenses with other manufacturers. Hughes enjoyed considerable success with the patent in the manufacture of satellites for commercial customers (Pl.Br. (6/25/89) at 44-54). It is axiomatic that a non-exclusive license earns a lower royalty than an exclusive one.

4

The non-exclusive license taken by the government was a mere "naked" license to use the attitude control process described in the Williams patent, unaccompanied by technology or practical know-how necessary to design and incorporate the invention into a complex spacecraft. The user of the license was left to expend the financial resources to develop the spacecraft design necessary for implementation of the attitude control system. All risk associated with selection and use of a particular attitude control system was taken by the user. This factor would have the effect of lowering rather than enhancing the level of a reasonable royalty.

5

A negotiator for Hughes in 1973 would have every incentive to set a rate which would simultaneously encourage use of the Williams invention in every space vehicle capable of being spun up (even if only as a redundant backup system), thus contributing to the size of the compensation base, and discourage or delay the development of alternative, competing technology.

The most effective way to accomplish this twin objective would be to set the royalty rate at a level sufficiently attractive to induce use of the patent on every spinning spacecraft, even when not essential to the mission, and to encourage concentration of government and industry talent on remaining, unresolved

space engineering problems. A rate of one percent would have been an acceptable "insurance premium" even when the Williams system was not to be the primary attitude control system on a spacecraft; a rate significantly higher would discourage use of Williams as a redundant system and guarantee concentration of effort on alternatives.

One of plaintiff's valuation experts, George E. Frost, formerly director of the Patent Section of General Motors Corporation, wrote for a program in June 1979 (General Motors' Approach to Licensing, DX 2315-A at 2-3): "When we do not license we know that the possible licensee will almost surely find an alternative. So granting a license usually provides some income where none would otherwise exist." He also wrote, *id* at 5: "[I]t is a mistake to assume that any patent is free of alternatives, and the terms of any good license reflect this."

Relevant to concerns that designers might try to "design around" Williams, there were other systems available. By no means did every spacecraft launched as of September 1973, or even a majority, have the Williams system (Pl.Br. (7/25/89) at 53-54). "Plaintiff acknowledges that other control systems were used" (*Id.* at 79). "Hughes has never denied there were alternatives to the Williams invention for some applications" (*Id.* at 81- 82).

By September 1973, enormous effort and talent in government and industry in Europe and North America were being successfully devoted to improvements in all aspects of space technology, including alternatives to Williams. At that time, there was already the capability of launching a 1600-pound, three-axis stabilized spacecraft into synchronous orbit using

the comparatively inexpensive Atlas-Centaur booster (PX 1350). Indeed, in May 1966, an Atlas-Centaur had launched the 2200-pound Surveyor 1 to the moon (PX 1237 at 208); in 1977, an Atlas-Centaur launched the 2200-pound, three-axis stabilized FLTSATCOM directly into synchronous orbit. Many of the spacecraft in this compensation base were not placed into geosynchronous orbit but rather had comparatively low earth orbits for which an Atlas-Centaur could be used to launch a three-axis satellite directly into final orbit. Further, for low earth orbits, alternative attitude control systems such as magnetic torquing were possible, though less desirable alternatives. Hughes would have wanted to discourage all such alternatives.

More important for present purposes, other systems and more powerful rockets were on the way. Just eight months after the patent issued, the ATS-6, a three-axis stabilized, geosynchronous-orbit communications satellite weighing 3000 pounds, was launched into final orbit aboard a Titan IIIC rocket. It did not employ the Williams technology. Although the Titan IIIC was approximately four and a half times as expensive as the less powerful Atlas-Centaur, use of which would have required a transfer orbit ($180 million v. $40 million), the Titan IIIC could launch several spacecraft simultaneously, bringing its per- vehicle cost close to that for single-vehicle launches on the Atlas-Centaur. Although such use would involve increased risk in the event of a launch mishap, there was very early in the patent period a reliable, technically possible alternative means to launch heavy satellites into geosynchronous orbit.

By 1974, some major commercial customers had elected to use three-axis attitude control systems on broadcast satellites (DX 2100). By 1982, slightly more

than one-half way through the patent period, technology had advanced to the point that heavy spacecraft could be launched into high orbit using a transfer orbit without the use of the Williams attitude control system.

The hypothetical Hughes negotiator would have wanted to discourage development and exclusive use of competitive alternatives, or at least remove any incentive to concentrate effort in this area until near end of the patent period. A royalty rate of one percent would have contributed to this goal.

6

For the sake of completeness, we note that plaintiff is not entitled to any premium or other favorable consideration in the hypothetical rate negotiation by reason of the fact that the government's use of the patent has resulted in plaintiff's competitors receiving contracts to manufacture spacecraft incorporating the Williams invention and thus reducing Hughes' otherwise exclusive control over its patent. Hughes never had any right to exclude such use, only a right to compensation for any such use which occurred. The government had a perfect legal right to use the patent-in-suit (and any other U.S. patent) without prior authorization of the patentee. *Bendix Corp. v. United States*, 230 Ct. Cl. 247, 250, 676 F.2d 606, 608 (1982) ("unlike the private infringer, the United States in a § 1498 case is doing what it has a right to do"); *Decca, Ltd.*, 225 Ct. Cl. at 335, 640 F.2d at 1166 ("Because section 1498 authorizes the Government to take a license in any . . . patent, the Government is never 'guilty' of 'direct infringement' of a patent insofar as . . . [this] connotes tortious or wrongful conduct."). See *Leesona Corp. v. United States*, 220 Ct. Cl. 234, 244-54,

599 F.2d. 958, 964-70, *cert. denied*, 444 U.S. 991, 100 S. Ct. 522, 62 L.Ed.2d 420 (1979).

H

Plaintiff asserts entitlement to a royalty rate of 15 percent. For support, Hughes points to a 1965 agreement between it and Communications Satellite Corporation (Comsat) pertaining to the manufacture of Intelsat II satellites (PX 1375-8 at C13663, C13685). Although the Williams patent had not been issued at the time, the 1965 agreement contained a provision, appearing at page 22 thereof (*id.* at C13685), that after the issuance to Hughes of two patents, only one of which involved the Williams technology which is the subject of this case, Comsat would pay a royalty of 15 percent of spacecraft cost for future use of the attitude control system "described and claimed" in two patent applications. Such royalty was to be payable, however, only if a satellite using the control system "is placed in a satisfactory orbit and commences satisfactory communications operation" (*id.*).

We find no support in this agreement for Hughes' current position. As an initial matter, even if the agreement were otherwise supportive of Hughes' claim, the agreement on its face provides a 15 percent royalty only with respect to successfully launched satellites whereas plaintiff is claiming 15 percent with respect to all government spacecraft whether or not successfully launched. Gayle Parker, a valuation expert called by Hughes, conceded that even if this agreement resulted in an "established royalty," Hughes would be entitled to no more than 13.3275 percent of the cost of the accused spacecraft after taking account of unsuccessful launches (Tr. 2275, 2287-88). Further, the 1965 Comsat agreement provides liability for the royalty upon use of the

technology described in two patent applications, whereas we are here dealing with only one patent. However, there are more fundamental reasons for rejecting this agreement as guide for negotiations.

For one thing, the agreement was entered eight years before the Williams patent was issued to Hughes, at which time the claims of the Williams application were far broader than those of the patent-in-suit. Subsequent to this agreement, Hughes abandoned all claims in the Williams application referred to in the 1965 agreement and substituted three others. Further, the 1965 Comsat agreement was entered at a time when Hughes was literally the world's only aerospace contractor to have successfully manufactured satellites for geosynchronous orbit. Consequently, Hughes then had some leverage which it could not have applied (and, more importantly, did not try to apply) after the Williams patent issued in 1973. The tremendous effort devoted to scientific and engineering advances in the space field during the 1960's (the United States landed a man on the moon in 1969) and early 1970's by both government and private industry resulted in the existence of several experienced major aerospace companies by 1973. Further, by the time the Williams patent issued in 1973, far more powerful launch boosters were available, making the use of the Williams attitude control system less critical.

We find more convincing the conduct of Hughes (described above) after the patent issued, a time when plaintiff had reason to feel secure concerning its royalty-rates bargaining position and when the Williams invention was well established as the desirable, reliable and light-weight attitude control system for any spacecraft capable of being spun up. After the

patent issued in 1973, Hughes never asked from anyone, in the context of seeking a voluntary licensing arrangement pertaining solely to the Williams patent, a royalty of as much as three percent (when adjusted to "total spacecraft cost"). One may fairly inquire: If a reasonable royalty was 15 percent or even 13 percent of total cost, why was Hughes offering to license the Williams invention to its major commercial competitors early in the patent term—the time of maximum value—for less than three percent of total spacecraft cost (making no mention of the 1965 Comsat agreement), and why were there no takers among three of the world's leading satellite manufacturers, not even a counteroffer from two of them.

I (EYE)

Based on all the foregoing, we conclude that a reasonable royalty rate to be applied to total spacecraft cost for the government's use of the Williams invention is one percent. Application of this rate to the compensation base of $3,577.518 million, *see* Opinion on Compensation Base, dated April 29, 1994, slip op. at 24 & Appendix B at 4, results in a total royalty of $35.775 million.

IV

A

"Reasonable and entire" compensation necessarily includes delay damages, i.e., recompense tantamount to interest for loss of use of royalties which a prevailing patentee would have enjoyed had payment of such royalties been timely.[11] This principle is well

[11] "The 'reasonable and entire compensation' due plaintiff under 28 U.S.C. § 1498 includes not only reasonable royalties but also an

established, is ably analyzed in *ITT Corp. v. United States*, 17 Cl. Ct. 199, 232-40 (1989), and does not require extensive additional explanation. Suffice it to say that the applicable standard of compensation requires putting the patent owner in as good a pecuniary position as it would have occupied had the royalty payments been timely and had they been invested in a prudent manner designed to produce a reasonable return while preserving principal.

B

There is a strong judicial policy in favor of uniform rates to apply to all those entitled to delay damages for a given period. *See Georgia-Pacific Corp. v. United States*, 226 Ct. Cl. 95, 154, 640 F.2d 328, 365 (1980) (stating in a takings case: "[I]n order to avoid discrimination among litigants, we . . . place great weight on the strong judicial policy requiring uniformity of treatment of condemnees."); *Miller v. United States*, 223 Ct.Cl. 352, 402, 620 F.2d 812, 838 (1980) ("There is . . . a strong judicial policy in favor of the establishment of a uniform rate of interest applicable to condemnation cases in order to avoid discrimination among litigants."); *Pitcairn*, 212 Ct. Cl. at 196, 547 F.2d at 1124, (rejecting as discriminatory the suggestion that a plaintiff's actual cost of borrowing be applied as delay damages rate: "A plaintiff with a poor credit rating could theoretically receive an award of just compensation at very high interest rates because its actual cost of borrowing money might be very high, while another might be penalized for having a good credit

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appropriate amount which compensates plaintiff for defendant's delay in payment of those royalties." *Pitcairn*, 212 Ct. Cl. at 189, 547 F.2d at 1120. See *Waite v. United States*, 282 U.S. 508, 51 S. Ct. 227, 75 L.Ed. 494 (1931).

rating."); *Arkansas Valley Ry. v. United States*, 107 Ct.Cl. 240, 259, 68 F.Supp. 727, 730, *cert. dismissed*, 330 U.S. 811, 67 S. Ct. 1083, 91 L.Ed. 1266 (1947) (stating in a takings case: "A uniform rate does in fact avoid discrimination among litigants.").

C

Plaintiff, a successful corporation, urges use of its own return on equity as the measure of delay compensation, arguing that only this method can adequately place it in the financial position it would have enjoyed if the government had paid the royalties on a timely basis (Pl.Br. (4/13/89) at 10-39). Based on the long-standing, strong judicial policy in favor of uniform, non-discriminatory rates, we decline to adopt plaintiff's suggestion and instead adopt uniform rates.[12]

D

1

The earliest date for commencement of delay damages in this litigation is September 11, 1973, *see*

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[12] Adoption of the plaintiff's proposal to award delay damages to it on the basis of its unique return on equity would result in obvious discrimination between it and other just- compensation claimants entitled to delay damages by reason of the government's withholding of timely payment of principal over the same time periods. The anomaly is starkly illustrated by contemplating the result if the Williams patent had been owned half by the inventor Donald Williams and half by his employer, Hughes Aircraft Company. Under plaintiff's proposed method, the delay damages awardable to plaintiff would be based on generally high rates of return on equity while the delay damages recoverable by the actual inventor for the identical withholding periods would be substantially less (presumably based on objective rates recoverable by a prudent investor).

Appendix B to Opinion on Compensation Base filed April 29, 1994. Court of Claims precedent requires that a rate of 7.5 percent be used for delay damages accruing during 1973, 1974 and 1975.[13] *Tektronix, Inc. v. United States*, 213 Ct. Cl. 257, 268-69, 552 F.2d 343, 349 (1977), *reh'g denied*, 216 Ct. Cl. 144, 575 F.2d 832, *cert. denied sub nom. Hickok Elec. Instr. Co. v. Tektronix, Inc.*, 439 U.S. 1048, 99 S. Ct. 724, 58 L.Ed.2d 707 (1978). In *Miller*, 223 Ct. Cl. at 405, 620 F.2d at 840, a land takings case, the Court of Claims seemed to adopt a similarly binding rate of 8.5 percent for the years 1976-79.[14] The court also used a rate of 8.5 percent for the years 1976-79 in *Georgia-Pacific*, 226 Ct. Cl. at 154- 56, 640 F.2d at 365-66, another land takings case, and in *Bendix Corp.*, 230 Ct. Cl. at 265, 676 F.2d at 615-16, a patent case.

Based on this consistent Court of Claims application of rates for periods covering 1973 through 1979 in just compensation cases, we adopt those same annual rates

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[13] The series of specific rates set forth in *Pitcairn*, 212 Ct. Cl. at 191, 547 F.2d at 1121, based on long-term corporate bond yields, was adopted as the interest rates to be paid "from now on" in just compensation cases "without need of proof in the individual instance." *Tektronix, Inc. v. United States*, 213 Ct. Cl. 257, 274, 552 F.2d 343, 352 (1977), *cert. denied*, 439 U.S. 1048, 99 S. Ct. 724, 58 L.Ed.2d 707 (1978). For the years 1971-75, the rate adopted was 7.5 percent. *See Decca*, 225 Ct. Cl. at 337, 640 F.2d at 1168.

[14] The suggestive language from *Miller* is as follows:

> Applying an analysis similar to that employed in *Pitcairn*, we conclude that a rate of 8 1/2 percent would be appropriate for the years 1976-79. For the year 1980 to the date of payment, we approve a rate of 12 percent. Since this is only a short period of time, the 1980 rate here allowed will not be regarded by the court as a precedent for other cases.

223 Ct. Cl. at 405, 620 F.2d at 840.

for application in this case, to wit, 7.5 percent for the period 1973 through 1975 and 8.5 percent for the period 1976 through 1979. Because, as explained below, we adopt the tax overpayment rates prescribed by 26 U.S.C. § 6621 for delay damages accruing on or after February 1, 1980, we hold, for the sake of administrative convenience, that the 8.5 percent rate shall also apply during the month of January 1980. (The Court of Claims similarly extended the 1976-79 rate through January 1980 to reach the same practical result in *Bendix Corp.*, 230 Ct. Cl. at 265, 676 F.2d at 616.)

2

The uniform rates applied in the delay damages cases just cited were applied as simple interest. We must determine if it is appropriate to allow compound interest when using those rates and, if so, what the period of compounding should be. As a matter of general principle, both parties in this case agree that compounding is appropriate. Experts for both sides testified to the effect that, at all times relevant in this case, no rational investor would consider investing at simple interest.[15] We are absolutely persuaded that simple interest with respect to any time period relevant in this case would not be commercially reasonable and would not place the plaintiff "in as good a position

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[15] We adopt for this case the conclusions of the court in *ITT Corp.*, 17 Cl. Ct. at 242, as follows:

> [R]equiring plaintiff to adduce evidence of a market or commercial fact not subject to debate, i.e., that any commercial player borrows at compound interest, is not a meaningful evidentiary effort. . . . The court is prepared to take judicial notice that compound interest is a market or commercial reality for any corporation that does business in the United States.

pecuniarily as . . . [it] would have occupied if the payment had coincided with" each taking of a patent license, *Kirby Forest Indus. v. United States*, 467 U.S. 1, 10, 104 S. Ct. 2187, 2194, 81 L.Ed.2d 1 (1984). *See Dynamics Corp. of America v. United States*, 766 F.2d 518, 520 (Fed.Cir. 1985); *Whitney Benefits, Inc. v. United States*, 30 Fed. Cl. 411, 413 (1994); *ITT Corp.*, 17 Cl. Ct. at 239-40.

We find that just compensation in this case requires compounding of interest at least annually. Because we are mindful that rate of interest and compounding period are inextricably related so that a change from simple to compound interest necessarily increases the effective rate of interest after the initial interest period, we select an annual compounding period for application between September 11, 1973 and January 31, 1980, even though we would otherwise be inclined to select a shorter compounding period. On the other hand, we are persuaded that the unavoidable modification to the simple interest rates we apply as annually compounded rates does not do violence to the precedent upon which those rates are based, especially in light of the Federal Circuit's opinion in *Dynamics Corp. of America*, 766 F.2d at 520. For ease of application and to match the February 1, 1980 commencement date for application of rates under 26 U.S.C. § 6621, the annual compounding date will be January 31.

E

For delay damages accruing on or after February 1, 1980, we award the tax overpayment rates prescribed by 26 U.S.C. § 6621 (as modified from time to time),

compounded daily as provided in 26 U.S.C. § 6622(a).[16] *See Bendix Corp.*, 230 Ct. Cl. at 265, 676 F.2d at 606; *Dynamics Corp. of America v. United States*, 5 Cl. Ct. 591, 618 (1984), *aff'd in part, rev'd in part on other grounds*, 766 F.2d 518 (Fed.Cir.1985). These rates are conveniently set out, with references to applicable source documents, in [1994] 14 Stand. Fed. Tax Rep. (CCH) ¶ 40,355.02 and in [1994 Index] Stand. Fed. Tax Rep. (CCH) ¶ 175.

The amount of effort and the volume of materials devoted in this case just to the subject of delay damages approach the absurd. Approximately seven days of trial time were devoted to testimony and argument pertaining solely to this issue; voluminous exhibits on the subject were received. A generally-agreed, standard, objective method of fixing delay damages when the government has been found liable for past due royalty payments is sorely needed.[17]

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[16] Although urging use of its own return on equity as the measure of delay compensation, plaintiff acknowledges that if uniform rates are to be adopted, the tax overpayment rate set pursuant to 26 U.S.C. § 6621, combined with the daily compounding provided in 26 U.S.C. § 6622(a), should be used to calculate delay damages (Pl.Br. (4/13/89) at 40, 44-46; Tr. 17,712, 17,715).

[17] We have tremendous sympathy with the views expressed by Judge Oscar Davis in *Tektronix, Inc.*, 213 Ct. Cl. at 274, 552 F.2d at 353:

> "[I]t is too burdensome to require parties to make specific proof in every case as to the appropriate interest rate. . . . It will further the goal of equal justice, reduce the costs and complexity of litigation, and facilitate decision (as well as settlement) to accept and establish . . . [uniform rates]."

We find the current statutory overpayment rate to be a fair, easily ascertained, commercially reasonable, objective measure of delay damages automatically adjusted from time to time to take account of changing rates and conditions in the marketplace. The basic rate to be derived by the Secretary of the Treasury involves some aspects of the financial markets and presumably reflects investors' conclusions regarding a rate that will keep pace with inflation plus provide a measure of "real" return. Then, the addition of two percent insures that one entitled to delay damages will receive an additional margin of "real" return; this takes account of the likelihood that a prudent investor will place a portion of his assets in long-term securities which typically earn higher rates than short-term obligations. The result appears fair to a patentee entitled to past due royalties, yet also fair to the government which has statutorily declared this to be an appropriate rate when it has had the use of federal tax overpayments.

F

Although not objecting to the periodic compounding of delay damages rates as a matter of general principle, defendant argues that an award based on compound interest would provide a substantial benefit due to delayed federal income taxation (the "Individual Retirement Account effect") and urges application of an elaborate calculation to reduce the award of interest for each year by the presumed amount of federal income taxation which would have been due.

We decline to adopt defendant's approach for four reasons: First, case law rejects this approach. *See Hanover Shoe, Inc. v. United Shoe Machinery Corp.*, 392 U.S. 481, 503, 88 S. Ct. 2224, 2236-37, 20 L.Ed.2d

1231 (1968); *ITT Corp.*, 17 Cl. Ct. at 242-43. Second, a fair application of defendant's theory would require findings concerning a plaintiff's actual tax situation for each applicable year (more than 20 in this case) and speculation concerning actions which a reasonable recipient might have taken to reduce taxation on awards if received when due, e.g., timing of charitable giving, carryforwards and carrybacks, anticipation of losses.

Third, defendant's hypothetical taxation method would result in the same kind of discrimination among just compensation claimants that non-uniform rates of interest would cause. A plaintiff with chronic heavy losses or who resides or does business in a state with high state income taxes (deductible for federal income tax calculations) would receive more delay damages for a given period than an otherwise similarly situated plaintiff with chronic healthy profits or residence in a state with low taxes. Similarly, a foreign patentee not subject to United States income taxation would be treated more favorably than a domestic patentee.

Finally, Congress is undoubtedly aware of the beneficial effect of a compound interest award which presumes reinvestment of the full amount of interest earned at the end of each compounding period without reduction for taxes. Even so, although 26 U.S.C. § 6622 provides for daily compounding of interest on awards against the government in a variety of situations, Congress has not chosen to require any reduction of interest in the manner suggested by defendant.

G

In summary, we conclude that plaintiff is entitled to an award of delay damages computed at an annual rate of 7.5 percent over the period from September 11, 1973

through December 31, 1975 and at an annual rate of 8.5 percent from January 1, 1976 through January 31, 1980, compounded on January 31 of each year, and, commencing on February 1, 1980, computed in accordance with the tax overpayment rate prescribed from time to time in 26 U.S.C. § 6621 and compounded daily in accordance with 26 U.S.C. § 6622(a).

V

Despite efforts to be objective and precise in determinations of royalty rate and delay damages, it is well to keep in mind the conclusion of the Court of Claims with respect to these subject areas: "Determination of the amount of reasonable and entire compensation to which a successful plaintiff is entitled under 28 U.S.C. § 1498(a) is, in the final analysis, a matter of subjective judgment. There is no set formula or equation to fit all circumstances." *Bendix Corp.*, 230 Ct. Cl. at 266, 676 F.2d at 616.

VI

This opinion resolves all heretofore undetermined damages issues in this litigation. Application of the royalty rate and the delay damages rates set forth above to the valuations and royalty payment dates contained in Appendix B to the Opinion on Compensation Base, dated April 29, 1994, will yield the precise damages award to which plaintiff is entitled.

It is requested that the parties confer and attempt to reach agreement on the precise amount of a damages award which combines the royalty award and all delay damages accrued through March 31, 1994. It is contemplated that judgment shall be entered for such total amount of damages calculated as of March 31, 1994 plus interest on said sum calculated pursuant to 26

U.S.C. §§ 6621(a)(1) & 6622 (the tax overpayment rate compounded daily) from March 31, 1994 until paid.

The parties shall file a joint status report not later than Monday, July 18, 1994 setting forth their agreement on the precise amount of an award inclusive of delay damages through March 31, 1994 (without prejudice to appeal rights pertaining to any underlying court ruling), or, in the absence of agreement, their respective positions on an appropriate award and the precise matters requiring resolution by the court.

Judgment shall be entered upon such stipulation or other resolution of the precise amount of damages.[18]

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[18] Pursuant to RCFC 54(d), costs shall be allowed to the plaintiff ("the prevailing party"). Further, plaintiff is entitled to an award of fees, costs and expenses pursuant to this court's order dated May 19, 1988 (and plaintiff's application filed October 21, 1988) pertaining to discovery sanctions, the total amount of which will be set by separate order and included in the judgment.

APPENDIX E

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 94-5149, 95-5001

HUGHES AIRCRAFT COMPANY, PLAINTIFF-APPELLANT

v.

THE UNITED STATES, DEFENDANT/CROSS-APPELLANT.

[June 19, 1996]

Before ARCHER, Chief Judge, NIES, Senior Circuit Judge,* and BRYSON, Circuit Judge.

Opinion for the court filed by Chief Judge ARCHER. Concurring opinion filed by Circuit Judge BRYSON. Dissenting opinion filed by Senior Circuit Judge NIES.

ARCHER, Chief Judge.

Hughes Aircraft Company (Hughes) appeals the judgment of the United States Court of Federal Claims awarding Hughes compensation based on a 1% royalty rate with respect to spacecraft manufactured and used by or for the United States which embody the invention of Hughes' United States Patent No. 3,758,051 (the

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* Judge Nies assumed senior status on November 1, 1995.

Williams patent). *Hughes Aircraft Co. v. United States*, 31 Fed. Cl. 481, 35 USPQ2d 1243 (1994) (*Hughes XII*).[1] Hughes argues that the 1% royalty rate is too low. The United States cross-appeals contending that certain spacecraft were incorrectly included in the royalty base and that the interest rates used to calculate Hughes' delay damages were too high. We affirm.

BACKGROUND

A. The Williams patent relates to an apparatus for controlling the orientation of the spin axis of spin-stabilized space vehicles such as satellites positioned in orbit around the earth. The patent was issued to Donald Williams on September 11, 1973. To correct orbital deviations, the Williams apparatus applies a reactive force to the satellite by firing a jet so as to "precess," or tip, the satellite into the proper position. Although this technique was known in the prior art,[2] the Williams apparatus was the first to maintain its spin axis with reference to a fixed external coordinate system. *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1360, 219 USPQ 473, 479 (Fed.Cir.1983) (*Hughes VII*).

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[1] During this litigation twelve prior opinions have issued. The first eight reported decisions are listed in *Hughes Aircraft Co. v. United States*, 15 Cl. Ct. 550, 551 n. 2, 8 USPQ2d 1989, 1990 n. 2 (1988) (*Hughes IX*), and the tenth through twelfth are referenced in *Hughes XII*, 31 Fed. Cl. at 483 n. 2, 35 USPQ2d at 1244 n. 2. This ordering is used herein to number the *Hughes* opinions cited repeatedly. Two other decisions involving the Williams patent are listed in *Hughes IX*, 15 Cl.Ct. at 551 n. 2, 8 USPQ2d at 1990 n. 2.

[2] The McLean patent (United States Patent No. 3,216,674) was the first to disclose the basic concept of pulsing a jet to correct the spin axis of a satellite, and the government had a non-exclusive license to use it.

The present suit began in 1973 when Hughes brought a claim under 28 U.S.C. § 1498 against the United States for just compensation stemming from the use and manufacture by or for the government of spacecraft embodying the invention claimed in the Williams patent. During the course of the protracted litigation that followed, it was determined by the Court of Federal Claims that *Hughes* is entitled to just compensation with respect to 81 spacecraft. *Hughes Aircraft Co. v. United States*, 29 Fed. Cl. 197, 243-48, 29 USPQ2d 1974, 2010 (1993) (*Hughes X*). The court arrived at the final list of 81 spacecraft based in part on the 1983 decision of this court that certain accused spacecraft that use the "store and execute" method for controlling the precession jet infringe the claims of the Williams patent under the doctrine of equivalents. *Hughes VII*, 717 F.2d at 1366, 219 USPQ at 484. The Court of Federal Claims then found the value of the compensation base for calculating Hughes' award to be $3.577 billion, which was arrived at by using "total spacecraft cost," *i.e.*, the total procurement cost, including payload costs, to the government of the 81 spacecraft. *Hughes Aircraft Co. v. United States*, 31 Fed. Cl. 464, 468 n. 5, 477 (1994) (*Hughes XI*).

In, *Hughes XII* the Court of Federal Claims considered only the calculation of the amount of Hughes' award. The court first determined what royalty rate to apply to the compensation base to provide Hughes a reasonable royalty for the government's use of the patented invention. The court then considered the amount of pre-judgment interest (sometimes called "delay damages"), which together with the reasonable royalty would provide "reasonable and entire compen-

sation." *Hughes* XII, 31 Fed.Cl. at 483, 35 USPQ2d at 1251. Because an established royalty rate did not exist for licensing the Williams patent, the court determined the royalty rate using the "willing buyer/willing seller" rule. *Id.* at 484, 35 USPQ2d at 1245. Under this rule, a reasonable royalty is set at the rate that the court determines a "willing licensor and licensee would bargain for at hypothetical negotiations on the date infringement started." *State Indus. v. Mor-Flo Indus.*, 883 F.2d 1573, 1580, 12 USPQ2d 1026, 1031 (Fed. Cir. 1989).

The court's royalty rate analysis focused initially on three letters containing acceptable license terms that Hughes had sent to other aerospace companies during the period from 1974 to 1978, none of which resulted in a licensing agreement. The first was a July 1974 letter from Hughes to the Philco-Ford Corporation (Philco-Ford) offering to license the Williams patent and the McLean patent together for 5%, or separately for 3%, of "the sales price of the satellite calculated at the time it is delivered to the launch pad." *Hughes* XII, 31 Fed. Cl. at 486, 35 USPQ2d at 1246. Although Hughes' letter was sent while a suit was pending against Philco-Ford in which Hughes accused Philco-Ford of infringing the Williams patent, the court found nothing in the letter to suggest that the offer was part of a proposed settlement of the litigation and found that the letter was sent by Hughes merely in response to earlier requests by Philco-Ford for terms at which any licenses had been offered to parties unrelated to the suit. *Id.* at 486, 35 USPQ2d at 1247.

The second letter relied on by the court was sent by Hughes to TRW, Inc. (TRW) in September of 1974 and

offered a license at the identical rate described in the letter to Philco-Ford. *Id.* at 486, 35 USPQ2d at 1247. The court noted that there had never been any litigation or threat of litigation between Hughes and TRW relating to the Williams patent. *Id.* at 486, 35 USPQ2d at 1247. With regard to the TRW and Philco-Ford letters, the court found it significant that the anticipated royalty base underlying those offers was smaller than the royalty base in this case. *Id.* at 487, 35 USPQ2d at 1247.

The third letter was sent by Hughes to Messerschmitt-Bolkow-Blohm (MBB), a German corporation, as part of a series of letters regarding settlement of claims by Hughes against MBB. *Id.* at 487, 35 USPQ2d at 1247. As such, the court recognized that this letter could not fairly be considered an ordinary proposal of licensing terms. *Id.* at 487, 35 USPQ2d at 1247. The court instead relied on language in the letter in which Hughes stated that its "normal royalty rate" for licensing the Williams and McLean patents together was 5% of the "full contact price" for a commercial spacecraft or 2% of the "full contract price" for a scientific or experimental spacecraft, with the provision that the cost of scientific or experimental spacecraft did not include the cost of scientific or experimental payloads provided to MBB by others. *Id.* at 487, 35 USPQ2d at 1247. The court found that all of the 81 spacecraft in the royalty base were "scientific or experimental vehicles." *Id.* at 487, 35 USPQ2d at 1247. As Hughes had done in its Ford-Philco and TRW letters, the court reduced the 2% rate quoted in the MBB letter for both the Williams and McLean patents by a factor of 40% to arrive at a 1.2% rate for licensing only the

Williams patent for scientific or experimental vehicles. *Id.* at 487, 35 USPQ2d at 1247.

Based on the three offers, the Court of Federal Claims reasoned that negotiations would start at a rate of something less than 1.2% and that the negotiated rates would not fall below the 1% rate the government conceded would result in just compensation. *Id.* at 488, 35 USPQ2d at 1248. According to the court, the royalty rate would "quickly settle on one percent." *Id.* at 488, 35 USPQ2d at 1248. As additional support for the 1% royalty rate, the court pointed to the large size of the royalty base in this case. The court said that "[i]t is axiomatic that the larger the potential compensation base to which a royalty rate will be applied, the lower will be the rate." *Id.* at 488, 35 USPQ2d at 1248-49. The court also noted that Williams was not a "pioneer" invention, that the license taken by the government was non-exclusive and unaccompanied by know-how, that the Hughes license offers to the aerospace companies were not accepted, and that Hughes had an incentive to discourage the development of alternative technology and encourage the use of the Williams invention. *Id.* at 488-89, 35 USPQ2d at 1249-50. As to this last factor the court found that alternatives to the Williams invention existed in 1973 or were soon after developed. *Id.* at 489-90, 35 USPQ2d at 1250. Based on all of these factors, the court determined that a royalty rate of 1% would be reasonable.

The Court of Federal Claims next considered the appropriate interest rate to use in calculating the delay damages to be awarded Hughes because royalties were not currently paid. The court viewed delay damages as necessary to place Hughes in the position that it would

have been had the royalties been paid timely and invested in a prudent and reasonable manner. *Id.* at 492, 35 USPQ2d at 1251-52. For the period from September 11, 1973 to February 1, 1980, the court used rates which it viewed as required by or adopted in prior decisions for the years in question, citing *Tektronix, Inc. v. United States*, 213 Ct.Cl. 257, 552 F.2d 343, 193 USPQ 385 (1977), *Miller v. United States*, 223 Ct. Cl. 352, 620 F.2d 812 (1980), and *Bendix Corp. v. United States*, 230 Ct. Cl. 247, 676 F.2d 606 (1982). Specifically, it used a rate of 7.5% for the period up to 1975 and a rate of 8.5% for the period from 1976 to February 1, 1980. *Hughes* XII, 31 Fed. Cl. at 492-93, 35 USPQ2d at 1252-53. For the remainder of the period of delay, the court applied the relevant tax overpayment rate as prescribed in 26 U.S.C. § 6621, which was defined as 2% above the federal short term rate determined by the Secretary of the Treasury. The court found the tax overpayment rates to be fair, easily ascertainable, commercially reasonable, and objective, with the federal short term rate reflecting the short-term financial market and the 2% additional margin taking into account the fact that long term investments generally earn higher rates. *Id.* at 494, 35 USPQ2d at 1253-54. The court held that the delay damages for the period from 1973 to 1980 should be compounded annually and for the period after February 1, 1980 should be compounded daily as provided for in the tax overpayment compounding provision, 26 U.S.C. § 6622(a). *Id.* at 493, 494-95, 35 USPQ2d at 1253, 1254.

B. In this appeal Hughes puts forth several grounds for reversing the Court of Federal Claims' decision that its compensation should be limited to a 1% royalty rate. Hughes argues that the court erred as a matter of law

by treating the rates contained in the letters to Ford-Philco, TRW and MBB as a ceiling on the royalty rate. Also, Hughes asserts that the rates contained in the letters were artificially low due to widespread infringement of the Williams patent and due to the settlement context in which two of them were sent. Hughes further contends that reliance on the letters was improper because this conflicts with the policy behind Federal Rule of Evidence 408 which in certain circumstances requires the exclusion of evidence of offers made attempting to compromise a disputed claim. Finally, Hughes argues that the determination of the 1% royalty award was based upon three clearly erroneous factual findings. Specifically, Hughes takes issue with the findings that all of the 81 spacecraft determined to be compensable were "scientific or experimental" as that designation was used in the MBB letter, that the royalty base contemplated in the three letters was relatively smaller than the royalty base at issue here, and that during the term of the Williams patent non-infringing substitutes were available. Although it sought a 15% royalty rate before the Court of Federal Claims, Hughes now argues that it is entitled to at least a 3% royalty rate, which it derives from the proffered royalty rate for license of the Williams patent as set forth in two of the letters to the aerospace companies.

The government in its cross-appeal makes two arguments. First, it contends that the delay compensation rates were erroneous as a matter of law because they reflect a risk premium that Hughes did not bear. Moreover, the government says the court erred in failing to account for the annual taxes Hughes would have been required to pay had the royalties been paid currently.

Second, the government asserts that Hughes is not entitled to compensation for spacecraft using the "store and execute" method for controlling the precession jet because, despite the contrary holding in *Hughes* VII, these spacecraft do not infringe the Williams patent. The government asks us to reject *Hughes* VII as law of the case in view of the subsequent holding in *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 4 USPQ2d 1737 (Fed.Cir.1987) (*in banc*), which it suggests is inconsistent with the doctrine of equivalents analysis applied in *Hughes* VII.

DISCUSSION

I.

A. The government's unlicensed use of a patented invention is properly viewed as a taking of property under the Fifth Amendment through the government's exercise of its power of eminent domain and the patent holder's remedy for such use is prescribed by 28 U.S.C. § 1498(a). *Pitcairn v. United States*, 212 Ct.Cl. 168, 547 F.2d 1106, 1114, 192 USPQ 612, 616 (1976); *see also Leesona Corp. v. United States*, 220 Ct.Cl. 234, 599 F.2d 958, 966- 67, 202 USPQ 424, 432-33 (1979) (discussing the various ways patent infringement by the government was characterized prior to the enactment of 28 U.S.C. § 1498); *Decca Ltd. v. United States*, 225 Ct. Cl. 326, 640 F.2d 1156, 1166, 209 USPQ 52, 59 (1980). Under section 1498(a), the patent owner is entitled to its "reasonable and entire compensation for such use and manufacture." Because recovery is based on eminent domain, the proper measure is "what the owner has lost, not what the taker has gained." *Leesona*, 599 F.2d at 969, 202 USPQ at 435. Generally, the preferred manner of reasonably and entirely com-

pensating the patent owner is to require the government to pay a reasonable royalty for its license as well as damages for its delay in paying the royalty. *See, e.g., Decca*, 640 F.2d at 1167-68, 209 USPQ at 60 (discussing the various methods for valuing a patent license taken by the government); *Leesona*, 599 F.2d at 973, 202 USPQ at 438 (same). The parties do not dispute that this is the proper form of compensation; rather, they disagree as to the amount of compensation due and the manner in which it was determined.

Valuation determinations for purposes of eminent domain are reviewed for clear error as are determinations of what constitutes a reasonable royalty. *Whitney Benefits, Inc. v. United States*, 926 F.2d 1169, 1177-78 (Fed.Cir.1991); *Branning v. United States*, 784 F.2d 361, 364 (Fed.Cir.1986); *SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 926 F.2d 1161, 1164, 17 USPQ2d 1922, 1925 (Fed.Cir.1991); *Unisplay, S.A. v. American Elec. Sign Co.*, 69 F.3d 512, 517 n. 8, 36 USPQ2d 1540, 1544 n. 8 (Fed.Cir.1995). We will reverse a finding as clearly erroneous only if on the entire evidence we "are left with the definite and firm conviction that a mistake has been committed." *SmithKline*, 926 F.2d at 1164, 17 USPQ2d at 1925 (quoting *United States v. United States Gypsum Co.*, 333 U.S. 364, 395, 68 S. Ct. 525, 542, 92 L.Ed. 746 (1948)). In determining what constitutes a reasonable royalty, the court has discretion to make certain subsidiary decisions, such as what methodology to use to arrive at a reasonable royalty, and those decisions are reviewed for an abuse of discretion. *SmithKline*, 926 F.2d at 1164, 17 USPQ2d at 1925; *Unisplay*, 69 F.3d at 517 n. 8, 36 USPQ2d at 1544 n. 8.

B. Hughes asserts that the Court of Federal Claims held as a matter of law that the rates contained in the letters to Ford-Philco, TRW and MBB established a ceiling to the royalty rate. It contends that this was a legal conclusion, not a factual finding, and that the court's conclusion is erroneous. The court, however, did not hold as a matter of law that a reasonable royalty can never go above the amount specified in a license offer. Rather, the court analyzed the three letters at issue, as well as other factors, *Hughes* XII, 31 Fed. Cl. 481 at 488-90, 35 USPQ 2d at 1248-50, and found that in this case the rates quoted in the letters had the effect of placing a ceiling on the royalty rate. *See Unisplay*, 69 F.3d at 519, 36 USPQ2d at 1545-46 (holding that a reasonable royalty larger than that contained in license proposals and agreements was not supported by the evidence). Thus, while trying to cast its argument as one attacking a legal conclusion, Hughes is in essence challenging the court's factual findings based on its weighing of the evidence. That, however, is the special province of the trial court and we review such factual findings for clear error. *Inwood Lab., Inc. v. Ives Lab., Inc.*, 456 U.S. 844, 856, 102 S. Ct. 2182, 2189, 72 L.Ed.2d 606 (1982).

Both parties rely on the Court of Claims decision in *Pitcairn* to support their respective positions on whether offers to license a patented invention should or should not be viewed as a ceiling to the reasonable royalty. *Pitcairn*, however, provides no hard and fast rule. *Pitcairn* illustrates that the circumstances surrounding the industry as a whole as well as other relevant factors should be considered to determine what weight to afford an offer to license an invention. The facts of a particular case may call for a reasonable

royalty that is more, less or the same as the offered royalty. *See Pitcairn*, 547 F.2d at 1118, 192 USPQ at 618-19 (finding it appropriate under the facts of that case to take into account offers to license a patent when determining a reasonable royalty).

The Court of Federal Claims, as is appropriate, looked at the relevant facts and circumstances at the time when infringement began. As set forth above, the court relied on numerous factors in addition to the Hughes license offers as supporting its finding that hypothetical negotiators would not have agreed to a license at a rate greater than 1.2%. Based on the evidence we are not convinced that the court clearly erred in determining that the ceiling royalty rate in a hypothetical negotiation would be 1.2%.

Hughes also contends that the court clearly erred by failing to take into account the consequence of widespread infringement of the Williams patent. We discern no such failing and are not convinced that any upward adjustment of the court's royalty determination is required for this reason.

The cases cited by Hughes do not, as it argues, support the broad proposition that the court must reject or give very little weight to offers made when there is widespread infringement. Rather these cases stand for the proposition that the entirety of the circumstances should be considered and that the court can consider the effects of infringement. *See, e.g., Sun Studs Inc. v. ATA Equip. Leasing, Inc.*, 872 F.2d 978, 994, 10 USPQ2d 1338, 1351 (Fed.Cir.), *vacated in part*, 872 F.2d 978, 11 USPQ2d 1479 (Fed.Cir.1989), *overruled on other grounds, A.C. Aukerman Co. v. R.L.*

Chaides Const. Co., 960 F.2d 1020, 22 USPQ2d 1321 (Fed.Cir.1992) (stating that a court can take into account the commercial consequences of infringement and need not act as if there had been no infringement); *Deere & Co. v. International Harvester Co.*, 710 F.2d 1551, 1557, 218 USPQ 481, 486 (Fed.Cir.1983) (stating that the district court could discount the probative value of a license negotiated against a backdrop of continuing litigation); *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1078-79, 219 USPQ 679, 682 (Fed. Cir. 1983) (stating the trier of fact did not err in rejecting offers to license after infringement had begun as evidence of an established royalty); *Nickson Indus. v. Rol Mfg. Co.*, 847 F.2d 795, 798, 6 USPQ2d 1878, 1880 (Fed.Cir.1988) (stating that a higher royalty "may be awarded when the evidence clearly shows that widespread infringement made the established royalty artificially low").

While we agree that it is appropriate to look at what effect infringement has had on the value of a patent, the court need not consider that in a vacuum. It should take into account other evidence as was done in this case. The court expressly found that at the time of issuance of the Williams patent in 1973 "the space industry was a booming one with prospects for exponential growth" and that "[t]his was the context of Hughes' contacts with three major aerospace firms over the period from 1974 to 1978 in an effort to license the Williams patent." *Hughes* XII, 31 Fed. Cl. at 486, 35 USPQ2d at 1246. The court also considered the context in which the offers were made. It noted that one was made while litigation was pending but as a continuation of earlier licensing negotiations and not in settlement of that claim, that one was made in settlement of claims

but contained an indication of "normal" royalty rates and that the other was made while no litigation was pending. In addition, apart from its conclusory statements that infringement must have lowered the rates offered, Hughes has pointed to no evidence showing that the offers in the letters were actually reduced because of widespread infringement. While Hughes points to certain instances of infringement, it does not show that the license offers were affected by these infringements. In contrast, the court found that one of the letters expressly stated that the proffered royalty rate was Hughes' "normal" rate, not a low rate it was willing to accept because of infringement, thus belying on its face Hughes' contention that the royalty rate was depressed by infringement.

Because the Court of Federal Claims considered the infringement context in which the licensing offers were made as well as other pertinent facts, we are not convinced that the court clearly erred in failing to find that widespread infringement had depressed the indicated royalty rate.

Hughes' claim that the litigation context surrounding the Ford-Philco and MBB letters artificially lowered the rates contained in those letters is intertwined with the foregoing contention. Hughes also argues that those letters were statements made in compromise negotiations and that the court's consideration of them violates the policy behind Federal Rule of Evidence 408. Before the Court of Federal Claims, however, Hughes had no objection to the introduction of these letters and stated that because this case was tried to the court it was sure the letters would "be given the weight they deserve." Unable now to challenge their

admissibility, Hughes attacks the weight given these letters by the Court of Federal Claims. We have previously related the court's discussion of the litigation context of these offers, as well as other factors the court considered. Suffice it to say that we discern no clear error in the court's consideration of the Ford-Philco and MBB offers or in its failure to agree with Hughes' contention that the litigation artificially lowered the royalty rates proposed in these license offers.

Hughes also argues that the court's finding that the government's spacecraft were "scientific or experimental" as opposed to "commercial" as those terms were used in the MBB letter is clearly erroneous. After consideration of all the evidence, the court determined that the spacecraft were more akin to scientific and experimental vehicles than commercial vehicles. This finding is supported by the testimony of both parties' experts who each stated that the satellites were experimental and that the government was not in the business of operating satellites for profit. Moreover, Hughes has failed to point to any evidence showing that the spacecraft were being used for commercial purposes, that commercial profit was made, or that any other such indicia of commerciality existed. We therefore cannot say the court clearly erred in finding that the spacecraft should be considered experimental.

Finally, the court did not clearly err in supporting its determination of the royalty rate with the finding that the potential royalty base of the competitors receiving the royalty offers was smaller than the royalty base in this case, which included all spacecraft costs and payload costs, and with the finding that there were acceptable non-infringing alternatives. Hughes' evidence and

arguments are insufficient to overturn these findings. Furthermore, these findings were just two out of many that the court used to support its royalty rate determination and Hughes has failed to show that any error associated with these findings would be anything but harmless.

Because the Court of Federal Claims did not clearly err or abuse its discretion in its determination of a reasonable royalty rate, we affirm the 1% royalty rate.

II.

A. The government argues that the interest rates arrived at by the Court of Federal Claims to calculate delay damages overcompensate Hughes for the delay in payment. The government characterizes the royalties owed Hughes as similar to a loan to the government which carries no risk. Under this view, the government argues that the delay damages should be calculated based on the rates paid on Treasury bills. The government criticizes the rates used by the court as improperly including a premium for risk that Hughes did not bear.

A court has discretion in determining the delay compensation rate. *See Pitcairn*, 547 F.2d at 1122, 192 USPQ at 622 ("The determination of a proper amount of delay compensation is a judicial function. The discharge of that function requires the exercise of judgment."). In *Pitcairn*, the Court of Claims approved the use of long-term corporate bond yields as a measure of delay damages because they indicate broad trends and relative levels of investment yields and reflect the amount that the patentee has lost. 547 F.2d at 1122, 1124, 192 USPQ

at 622, 624. It then held in *Tektronix* that the 7.5% rate it found applicable for 1975 in *Pitcairn* "should be applied (from now on) to just compensation cases, without need of proof in the individual instance, unless and until it is affirmatively demonstrated that under the theory of the *Pitcairn* opinion the rate for years after 1975 should differ from [that rate]." 552 F.2d at 352, 193 USPQ at 394. The *Pitcairn* analysis was applied in *Miller* to determine that a rate of 8.5% would be appropriate in a land takings case for the years 1976 to 1979, 620 F.2d at 840, and in *Bendix*, to determine that the tax overpayment rates were appropriate for the period from January 1, 1980 to the date of judgment in that case, 676 F.2d at 615-16. The Court of Federal Claims did not abuse its discretion in adopting these rates for the applicable periods.

The government also argues that the methodology used by the court for calculating delay damages overcompensates Hughes by failing take into account the taxes Hughes would have paid in the years that royalty compensation was due. Expressing concerns about double taxation, the Supreme Court in *Hanover Shoe v. United Shoe Mach. Corp.*, 392 U.S. 481, 503, 88 S. Ct. 2224, 2237, 20 L.Ed.2d 1231 (1968), held that courts do not have to reduce a damage award by the amount of taxes that would have to be paid. This court has applied that rationale in other cases, *see Kalman v. Berlyn Corp.*, 914 F.2d 1473, 1482-83, 16 USPQ2d 1093, 1100 (Fed.Cir.1990), and it is equally applicable to delay damages.

In this case the Court of Federal Claims rejected the government's argument that damages should be reduced by prior years' taxes. It determined that such a

reduction (1) had been rejected by the case law; (2) would be speculative due to Hughes' particular tax situation, including what actions Hughes might have taken to reduce such taxes in prior years; and (3) was not provided for by Congress in the tax overpayment provisions. The court did not abuse its discretion in reaching this conclusion.

Finally, the government challenges the court's award of compound rather than simple interest. It is well settled that the determination whether to award simple or compound interest is a matter largely within the discretion of the trial court. *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1555, 35 USPQ2d 1065, 1077 (Fed.Cir.1995) (*in banc*); *accord City of Milwaukee v. Cement Div. Nat'l Gypsum Co.*, — U.S. ——, ——, 115 S. Ct. 2091, 2096, 132 L.Ed.2d 148 (1995) (stating that the allowance of prejudgment interest "rests very much in the discretion of the tribunal which has to pass upon the subject, whether it be a court or a jury" (quoting *The Scotland*, 118 U.S. 507, 518- 19, 6 S. Ct. 1174, 1175-76, 30 L.Ed. 153 (1886))); *Dynamics Corp. v. United States*, 766 F.2d 518, 520, 226 USPQ 622, 623 (Fed.Cir.1985) (holding that prejudgment interest may include compound interest). The government has failed to establish that the court abused its discretion in fixing the delay damages.

B. The government argues that *Hughes VII* should not be the law of the case after this court's in banc decision in *Pennwalt*. Thus, it asserts that "store and execute" (S/E) spacecraft do not infringe the Williams patent and should not be included in the compensation base.

In *Hughes VII*, this court noted two differences between the S/E spacecraft and the claimed invention of the Williams patent that precluded a finding of literal infringement: (1) certain of the S/E spacecraft do not contain the means for providing an indication of instantaneous spin angle (ISA) to ground control required by paragraph (e) of claim 1; and (2) none of the S/E spacecraft contain the means for receiving control signals for immediate execution required by paragraphs (f) and (g) of Claim 1.[3] 717 F.2d at 1361, 219 USPQ at 480. This court held, however, that the S/E spacecraft infringed the Williams claims under the doctrine of equivalents. The *Hughes VII* opinion noted that the trial court's doctrine of equivalents analysis failed to apply the doctrine properly to the claimed invention and erred in requiring "obvious and exact equivalents" for claim limitations. *Id.* at 1364, 219 USPQ at 482. Based on the specification and engineering evidence,

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[3] These paragraphs of claim 1 read as follows:

> e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;
>
> f. and means disposed on said body for receiving from said location control signals synchronized with said indication;
>
> g. said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

See Hughes VII, 717 F.2d at 1355, 219 USPQ at 475-76, for the entire claim 1.

the court concluded that "retention of the ISA position in an on-board computer, while transmitting sufficient information to enable the ground crew to use that computer-retained information to control the satellite, is the modern-day equivalent of providing an indication of ISA to ground" as required by paragraph (e) of claim 1. *Id.* at 1365, 219 USPQ at 483. It also determined that the external synchronization of the command signal with the ISA position as specified in paragraphs (f) and (g) is equivalent to the internal synchronization accomplished onboard the S/E spacecraft by using modern memory circuits. *Id.*, at 1366, 219 USPQ at 484. The court said that use of ISA information onboard as a reference point for firing the jet, instead of using the ISA information on the ground as a reference point, was merely a relocation in the function and did not change the function performed, the manner of operation, or the result obtained. *Id.* at 1366, 219 USPQ at 484.

Four years after *Hughes VII*, this court sitting in banc stated in *Pennwalt* that it was well settled under the doctrine of equivalents "that each element of a claim is material and essential, and that in order for a court to find infringement, the plaintiff must show the presence of every element or its substantial equivalent." 833 F.2d at 935, 4 USPQ2d at 1739-40 (quoting *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d 1528, 1523-33, 3 USPQ2d 1321, 1324-25 (Fed. Cir.1987)). The dissenting opinion in *Pennwalt* asserted that the majority was requiring the "obvious and exact equivalents" requirement that was rejected in *Hughes VII*. *Id.* at 941-42, 4 USPQ2d at 1744-45 (BENNETT, S.J., dissenting).

The government now argues that *Hughes VII* is inconsistent with *Pennwalt* primarily on the basis of the views expressed in the dissenting opinion. We, of course, have the power to revisit the decision of the *Hughes VII* court. The Supreme Court has instructed, however, that this power of courts to revisit their own prior decisions should be sparingly exercised by stating that "as a rule courts should be loathe to do so in the absence of extraordinary circumstances such as where the initial decision was 'clearly erroneous and would work a manifest injustice.'" *Christianson v. Colt Indus. Operating Corp.*, 486 U.S. 800, 817, 108 S. Ct. 2166, 2178, 100 L.Ed.2d 811, 7 USPQ2d 1109, 1117 (1988) (quoting *Arizona v. California*, 460 U.S. 605, 618 n. 8, 103 S. Ct. 1382, 1391 n.8, 75 L.Ed.2d 318 (1983)). The government has failed to show that any such circumstances exist.

In *Hughes VII* the court was faced with applying the doctrine of equivalents to a claim written in means plus function language, and thus had to apply the doctrine of equivalents to a claim which under 35 U.S.C. § 112, ¶ 6, included the structure of the specification and equivalents. The court concluded in this instance that the trial court had required "obvious and exact equivalents" which made the doctrine of equivalents analysis the same as for literal infringement, and that the court had, therefore, erred as a matter of law in applying that doctrine. 717 F.2d at 1364, 219 USPQ at 482.

In *Hughes VII*, as discussed above, the court noted the similarities and the differences between the claimed invention and the S/E spacecraft and the fact that the teachings of Williams were used to develop the S/E spacecraft. *Id.* at 1365-66, 219 USPQ at 482-83. It then

considered each claim limitation not literally found in the S/E spacecraft and looked at whether the elements of the S/E spacecraft performed the same function in substantially the same way to obtain the same result. *Id.* at 1365-66, 219 USPQ at 483-84. Because there was an equivalent for each claim limitation not literally met, *Id.* at 1365- 66, 219 USPQ at 483-84, the court concluded that the differences between the claimed invention and the S/E spacecraft were too insubstantial to avoid liability under the doctrine of equivalents. *See id.* at 1365, 219 USPQ at 483 ("Advanced computers and digital communications techniques developed since Williams permit doing on-board a part of what Williams taught as done on the ground .... [A]n embellishment made possible by post-Williams technology, does not allow the accused spacecraft to escape the 'web of infringement.'" (quoting *Bendix Corp. v. United States*, 220 Ct. Cl. 507, 600 F.2d 1364, 1382, 204 USPQ 617, 631 (1979))).

This analysis in the court's prior decision is therefore entirely consistent with *Pennwalt*, as well as this court's more recent in banc decision in *Hilton Davis v. Warner-Jenkinson Co.*, 62 F.3d 1512, 35 USPQ2d 1641 (Fed.Cir.1995), *cert. granted*, — U.S. ——, 116 S. Ct. 1014, 134 L.Ed.2d 95 (1996). There is no indication in the majority opinion in *Pennwalt* that *Hughes VII* was being overruled or that it was inconsistent with *Pennwalt*. Moreover, one member of the majority expressly countered the assertion of inconsistency put forth by the dissent by stating that *Hughes VII* merely distinguished equivalency in a doctrine of equivalents analysis from equivalency of structure of disclosed means in a § 112, ¶ 6 analysis. *Id.* at 949, 953, 4 USPQ2d at 1751, 1755 (NIES, J., additional views).

In *Hilton Davis*, we stated that the "application of the doctrine of equivalents rests on the substantiality of the differences between the claimed and accused products or processes, assessed according to an objective standard." 62 F.3d at 1518, 35 USPQ2d at 1645. We noted that the function/way/result test is properly used in many cases to measure the substantiality of the differences. *Id.* at 1518, 1522, 35 USPQ2d at 1645, 1648. Moreover, we stated that "the trial judge does not have discretion to choose whether to apply the doctrine of equivalents when the record shows no literal infringement" and may consider such evidence as copying. *Id.* at 1519, 35 USPQ2d at 1646. As described above, the *Hughes VII* court applied these very principles.

The dissent apparently would decide *Hughes VII* differently if the case were before this panel, arguing that the approach taken by the *Hughes VII* dissent is the approach required under current law. This is not, however, a sufficient justification to refuse to follow law of the case. There is little doubt that this was a close case and reasonable minds could differ on the proper outcome of *Hughes VII*. Indeed, one member of the *Hughes VII* court dissented. That this was a close case, however, counsels in favor of abiding by the law of the case. *Christianson*, 486 U.S. at 819, 108 S. Ct. at 2179, 100 L.Ed.2d 811, 7 USPQ2d at 1117 (" 'The doctrine of law of the case is . . . a heavy deterrent to vacillation on arguable issues.'" (quoting 1B James W. Moore, et al., Moore's Federal Practice ¶ 0.404[1] (1984))). Simply because a different panel might reach a different conclusion, does not mean that the earlier decision is "clearly erroneous." *See id.*

The dissent makes the further point that we should not consider the length of time this litigation has been pending and urges the court to stay the issuance of this decision until the Supreme Court decides *Hilton Davis*. Because no showing was made to justify staying the decision in this case, we should not ignore the fact that it has been ongoing for over twenty-three years. The "promptness of decision . . . in all judicial actions is one of the elements of justice." *Forsyth v. City of Hammond*, 166 U.S. 506, 513, 17 S. Ct. 665, 668, 41 L.Ed. 1095 (1897). The litigants in this action deserve finality. Over such a long period of time, the composition of the panels of this court and the judge assigned to the case at the trial level has necessarily changed. As a matter of course, different judges looking at the same case may not view it in the same way. But under the law of the case, we must give respect and force to legal decisions rendered by earlier panels, absent a clear showing of error or injustice. Any other result would unduly prolong this already drawn-out litigation.

CONCLUSION

The judgment of the Court of Federal Claims is affirmed for the reasons above set forth.

AFFIRMED.

BRYSON, Circuit Judge, concurring.

There is substantial force to Judge Nies's analysis of the doctrine of equivalents issue in this case. But while I agree with much of what she says, I cannot join the disposition that she proposes.

This court's law on the doctrine of equivalents has certainly evolved over time, and the first *Hughes* appeal comes from well back in this court's history. It may well be that if we were writing on a clean slate we would view the doctrine of equivalents issue in this case differently now than the court did at that time. Because the first *Hughes* appeal decided the equivalents issue, however, we are not free to address the issue *de novo*, as if the first appeal had not occurred or as if it were merely an interesting historical byway in the seemingly endless course of this litigation. The law-of-the-case doctrine counsels strongly against one panel's overturning an earlier panel's resolution of the same issue in the same case. Based on that doctrine, I join the opinion of the court in this case.

If the law-of-the-case doctrine is to have any substance, it must sometimes require a judge to uphold a ruling on a question that the judge would decide the other way if it were presented for the first time. In order to serve the interests of judicial economy, finality, and avoidance of "panel-shopping," the doctrine strongly discourages reconsideration of issues that a previous panel has addressed, fully considered, and decided. *See Roberts v. Cooper*, 61 U.S. 467, 481, 20 How. 467, 15 L.Ed. 969 (1857) ("there would be no end to a suit if every obstinate litigant could, by repeated appeals, compel a court to listen to criticisms on their

opinions, or speculate of chances from changes in its members"); *Central Soya Co. v. Geo. A. Hormel & Co.*, 723 F.2d 1573, 1580, 220 USPQ 490, 495 (Fed.Cir.1983). Moreover, in patent cases, where Congress has made special provision for interlocutory appeals, *see* 28 U.S.C. § 1292(c)(2), adherence to the law-of-the-case doctrine is especially important, as there are more opportunities for a party dissatisfied with a ruling from one panel to seek a different result from a second.

As a general matter, courts apply the law-of-the-case doctrine except when the case for departure is exceptionally clear, either because the controlling law has changed or the earlier decision is clearly erroneous and would lead to manifest injustice. *See Mendenhall v. Barber-Greene Co.*, 26 F.3d 1573, 1582, 31 USPQ2d 1001, 1007 (Fed.Cir.), *cert. denied*, — U.S. ——, 115 S. Ct. 582, 130 L.Ed.2d 496 (1994); *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 900, 221 USPQ 669, 679 (Fed.Cir.) (departures from the law of the case doctrine occur "very infrequently"; the clearly erroneous/manifest injustice exception is "stringent" and requires a "strong showing of clear error"), *cert. denied*, 469 U.S. 857, 105 S. Ct. 187, 83 L.Ed.2d 120 (1984); *see also Smith Intern., Inc. v. Hughes Tool Co.*, 759 F.2d 1572, 1576-80, 225 USPQ 889, 891-94 (Fed. Cir.), *cert. denied*, 474 U.S. 827, 106 S. Ct. 87, 88 L.Ed.2d 71 (1985). Whatever view I might take on the merits if the doctrine of equivalents issue in this case were before us for the first time, I do not think the prior disposition is so clearly erroneous or has so plainly been overtaken by subsequent developments that the law-of-the-case doctrine can be disregarded.

Judge Nies makes the separate point that, in light of the pendency of *Hilton Davis Chemical Co. v. Warner-Jenkinson Co., Inc.* in the Supreme Court, the wisest course for us would be to suspend resolution of this appeal until the Supreme Court decides that case. To bring this long-pending litigation to a close on the eve of what might be a dispositive resolution of the doctrine of equivalents issue, Judge Nies argues, would be injudicious.

If I felt that the panel's decision were the last stop on the voyage of this case, I might well agree with Judge Nies. But it is not the last stop. Besides seeking rehearing in this court, the government can petition for certiorari from the Supreme Court, with a request that the Court hold the case pending the disposition of *Warner-Jenkinson*. Thus, our decision today is not likely to deprive the government of the chance for a favorable judgment by stealing a march on the Supreme Court.

But why should we issue this decision if the result will simply be to put the government to the task of going through additional procedural steps to keep the judgment from becoming final while the government is waiting for the Supreme Court to decide *Warner-Jenkinson*? There are several reasons. First, we have a number of issues to resolve in addition to the doctrine of equivalents question. The panel is unanimous as to all but one of those issues. The resolution of the other issues may be useful in limiting the points on which the parties are in disagreement (it may be too much to hope that resolving some of the issues will provide a meaningful impetus to settlement in this case, but more information is usually better than less). In addition, we

cannot realistically suspend the proceedings in every case that could potentially be affected by the *Warner-Jenkinson* decision, which may be as much as a year away. One of the unfortunate features of the doctrine of equivalents as it has developed over time is that it has come to play a crucial role in a large percentage of patent infringement actions. If we hold this case pending the Supreme Court's decision in *Warner-Jenkinson*, how could we justify not suspending the appeal in every case raising a plausible doctrine of equivalents claim that comes before this court over the next year? Finally, the government has not asked us to suspend this appeal, even though the Supreme Court granted certiorari in Warner-Jenkinson several months ago. I assume that if the government felt strongly that its rights were at risk if this court should choose to apply law-of-the-case principles without awaiting a Supreme Court decision, we would have heard from government counsel by now. Absent a request for suspension, I agree that we should treat this case as we treat all others and decide it as soon as a disposition is ready, leaving the parties to protect their interests, if they choose, through the avenues of further review.

NIES, Senior Circuit Judge, dissenting.

I.

This appeal raises a novel question respecting the application of principles of "law of the case." In 1983, this court reversed a judgment of the United States Claims Court, *Hughes Aircraft Co. v. United States*, 215 USPQ 787 (Cl.Ct.1982) (*Hughes VI*) that certain store and execute (S/E) satellites did not infringe the claims of Hughes' U.S. Patent No. 3,758,051 (the '051 patent)

under the doctrine of equivalents and remanded the case for a determination of damages. *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 219 USPQ 473 (Fed.Cir.1983) (*Hughes VII*). Upon remand, Hughes asserted that an additional 94 spacecraft, differing in various ways from those that had been litigated, also used the '051 invention. Subsequent lengthy trial court proceedings resolved the issues of liability respecting these devices. The judgment now before us fixes the amount of compensation due under 28 U.S.C. § 1498.

II.

Hughes VII was one of the first cases of this court to present the issue of infringement under the doctrine of equivalents and resulted in a split decision. Some understanding of the technology and of the different views of the panel is helpful at this point. The '051 patent is directed to a system for control of a spin-stabilized communications satellite. The patent explains that communications over long distances are possible if the satellite is accurately placed and maintained in a "geosynchronous" orbit. In such an orbit, the position of the satellite and its velocity are such that the satellite appears to hover over one point on the Earth's surface. Accurate placement and maintenance of the geosynchronous orbit maximizes communications potential.

The importance of satellite placement gives rise to the need to correct for satellite drift. Williams teaches countering satellite drift in real-time by intermittently pulsing attitude control jet valves, which are located on the periphery of the satellite, thereby tilting or "precessing" the satellite. A radio transmitter on the

satellite sends instantaneous spin angle (ISA) position and orientation information to a ground crew on Earth. Once the satellite's existing and desired orientations are determined, the ground crew transmits control signals to the satellite which are synchronized with the spin position and orientation. In response, the control valves are immediately pulsed, precessing the satellite into position.

Claim 1 which is representative of the claims in suit requires (a) a body adopted to spin about an axis; (b) a fluid supply; (c) a valve connected to the fluid supply; (d) fluid expulsion means oriented to expel fluid, and the following additional elements:

> (e) means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;
>
> (f) and means disposed on said body for receiving from said location control signals synchronized with said indication;
>
> (g) said valve being coupled to said last-named means and responsive to said control signals for applying fluid to said fluid expulsion means in synchronism therewith for precessing said body to orient said axis in a predetermined desired relationship with said fixed external coordinate system.

The government spacecraft in issue do not send information to the ground crew and are not precessed upon a signal sent by the ground crew but are con-

trolled by a stored program in an on-board computer, *i.e.*, a store and execute system (S/E).

The majority, nevertheless, concluded that S/E spacecraft infringe because:

> The failure to apply the doctrine of equivalents to the claimed invention as a whole, and the accompanying demand for "obvious and exact" equivalents of two elements the presence of which would have effectively produced literal infringement, was error.
>
> . . . .
>
> [T]he S/E spacecraft, with the ISA position indication retained on-board, are equivalents of Williams' claimed satellite, with the ISA position indication sent to ground, performance of the function involving the ISA position being substantially the same in each. We agree.
>
> . . . .
>
> The S/E spacecraft uses sun pulses retained on-board as reference points to fire the jet. Williams uses sun pulses sent to ground as reference points to fire the jet. The difference between operation by retention and operation by sending is achieved by relocating the function, making no change in the function performed, or in the basic manner of operation, or in the result obtained.
>
> . . . .
>
> The S/E spacecraft and the claimed Williams satellite reflect the precise circumstance envisaged in *Graver*, *supra*, for they perform the same function

(receipt of and response to command signals from an external location to accomplish precession), in substantially the same way (jet firings synchronized, albeit later and internally, with ISA position) to obtain substantially the same result (controlled precession of spin axis in a predetermined direction to orient a hovering satellite).[4]

717 F.2d at 1364-66, 219 USPQ at 482-484.

One panel member, Judge Davis, agreed with the trial court that one or more elements required by the claims was not present in the accused S/E satellites, either exactly or by an equivalent thereof. More particularly, he would have affirmed the trial court's finding, *inter alia*, that the accused devices had no equivalent for the required "means . . . providing an indication" of the ISA "to an external location."[5] The

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[4] I note that the damage award is based on hovering and non-hovering government spacecraft. It is not disputed that most of the accused satellites are operated in non-geosynchronous orbits, *i.e.*, the satellites and the Earth move at different angular velocities, and therefore, unlike Williams' satellite, do not have to account for the propagation delay in transmitting the control signals between the satellite and Earth. The majority's finding of infringement did not, however, distinguish between hovering and non-hovering satellites.

[5] Judge Davis also concluded respecting other elements:

3. The same is true of the elements specifying the method for controlling the precession jet. In this regard, Williams, again as Judge Colaianni points out, limits its claims so as to require a ground controller, not only to determine the ISA, but also to use the ISA to pulse the precession jet during the desired portion of the spin cycle. As to the latter, the claims in suit also require means for pulsing the precession jet within a

claims expressly call for an attitude control system, a structure, on the spinning body which sends information on the ISA to a ground controller, who determines when a jet should be fired based in part on the ISA information. Judge Davis concluded:

> To find, as the majority does, in this self-contained on- board computer an equivalent of the specific requirement for providing an indication of ISA to the ground (so that the ground can take account of ISA) is simply to obliterate and disregard this element of the claims. These accused structures may possibly obtain "the same result" as Williams but they do not perform "the same function" in "the same way" either literally or substantially. Whether or not this on-board device for calculation would be unobvious—and there is no finding and (to my mind) no showing that it would have been obvious—its substitution was not a proper equivalent for infringement of this non-

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fixed time period after the receipt of the control signal. This does not occur in any of the accused structures, nor does the ground location use ISA to determine the execute command.

. . . . Moreover, in Williams there must be a fixed time period between the receipt by the spacecraft of a control signal and the activation of the precession jet. In the S/E satellites, in contrast, neither the ground nor the execute signal operates to activate the precession jet within a fixed time period (instead, that period varies). The sum of it is that the S/E structures perform a "different function" in a "different way" from those claimed by Williams—and are therefore not within the *Graver* principle.

717 F.2d at 1367-68, 219 USPQ at 485-86.

> pioneer patent because the wholly on-board computer device operated in a different way to perform the different function of a significant calculation unrelated to ground personnel.[6] Unlike the Court of Claims decisions cited in the court's opinion this is not the case of a "sophisticated" technique of performing the same function in the same way. It is a "sophisticated" method of performing a different function in a different way. Even if the standard of "obvious and exact equivalents" (*Eastern Rotorcraft Corp. v. United States*, 397 F.2d 978, 982, 184 Ct.Cl. 709, 158 USPQ 294 (1968)) is considered as too narrow, the accused devices here are definitely outside the equivalence principle of *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608, 70 S. Ct. 854, 856, 94 L.Ed. 1097 (1950).

717 F.2d at 1367, 219 USPQ at 485.

The government argues in its brief and at the hearing that the *Hughes VI* finding of *noninfringement* by S/E satellites would be affirmed under the precedent of *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 4 USPQ2d 1737 (Fed.Cir.1987) (*in banc*), *cert. denied*, 485 U.S. 961, 108 S. Ct. 1226, 99 L.Ed.2d 426, 485 U.S. 1009, 108 S. Ct. 1474, 99 L.Ed.2d 703 (1988), and its progeny; and that it should not be held liable for infringement of the '051 patent for acts which would not constitute infringement by anyone else. Further it urges that this court must apply the law of *Hilton*

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[6] The majority quotes Hughes' expert as testifying that it would have been obvious to place the calculating device on the spacecraft but the Government's witnesses testified that this device was not an equivalent.

Davis Chemical Co. v. Warner-Jenkinson Co., 62 F.3d 1512 (Fed.Cir.1995) (*in banc*), *cert. granted*, —— U.S. ——, 116 S. Ct. 1014, 134 L.Ed.2d 95 (1996), an *in banc* case on the doctrine of equivalents then pending, whatever the holding might be. Hughes counters that *Hughes VII* is not in conflict with *Pennwalt* and that, in any event, this court should not revisit liability issues after these many years even if the law in the *Hughes VII* decision is wrong. In addition, Hughes argues that the government waived its right to reargue that its S/E satellites do not use the '051 invention because the government did not argue below that the law had changed. Respecting *Hilton Davis*, Hughes argues that it would be manifestly unjust to apply retroactively any new test that might be adopted therein.

III.

Unlike *res judicata*, the law of the case does not involve preclusion after final judgment, but rather it regulates judicial affairs before final judgment. 18 CHARLES A. WRIGHT, ET AL., FEDERAL PRACTICE AND PROCEDURE § 4478 (1981). A court will not generally revisit an issue once decided during the course of litigation. "Although courts are often eager to avoid reconsideration of questions once decided in the same proceeding, it is clear that all federal courts retain power to reconsider if they wish." *Id.* As Justice Holmes stated, the law of the case doctrine "merely expresses the practice of courts generally to refuse to reopen what has been decided, not a limit to their power." *Messenger v. Anderson*, 225 U.S. 436, 444, 32 S. Ct. 739, 740, 56 L.Ed. 1152 (1912). The Supreme Court has also explained that "there is a difference between [law of the case] and res judicata; one directs

discretion, the other supersedes it and compels judgment." *Southern Ry. Co. v. Clift*, 260 U.S. 316, 319, 43 S. Ct. 126, 127, 67 L.Ed. 283 (1922). *See also Arizona v. California*, 460 U.S. 605, 618, 103 S. Ct. 1382, 1391, 75 L.Ed.2d 318 (1983). Thus, Hughes is correct that a court has some discretion under "law of the case" principles. However, the federal courts of appeals have uniformly recognized that an intervening change in applicable law is a strong basis for reconsideration of a decided issue in a pending case. *Dean v. Trans World Airlines, Inc.*, 924 F.2d 805, 810 (9th Cir.1991) (Supreme Court decision changed applicable law); *Miles v. Kohli & Kaliher Associates, Ltd.*, 917 F.2d 235, 242 (6th Cir.1990) (state Supreme Court decision changed applicable law in diversity case); *Doe v. Anrig*, 728 F.2d 30, 31 (1st Cir.1984) (decision by the same court of appeals changed applicable law); *Wooster v. Handy*, 21 F. 51, 53-54 (C.C.S.D.N.Y.1884) (decree of patent validity reconsidered after Supreme Court decisions relating to the validity of reissued patents).

A.

As an initial matter, Hughes' argument is clearly untenable that the government has "waived" its right to argue for application of the current law at this stage of the proceedings. The government conceded only that, under our prior *Hughes* decision, certain additional S/E satellites could not be distinguished from the ones already found to be infringing. Nor could the government appropriately argue to the trial court that it did not have to follow the explicit mandate of this court during the course of the later damages phase because of a change in the law. The trial court must follow the appellate court mandate until the appellate

court itself changes it. *In re Roberts*, 846 F.2d 1360, 1363, 6 USPQ2d 1772, 1774 (Fed.Cir.1988) ("Unlike the authority to reconsider its own rulings, a district court is without choice in obeying the mandate of the appellate court."). However, at all times, the government expressly preserved the S/E infringement issue for appeal, and Hughes does not challenge the right of the government to petition the Supreme Court for review of all infringement issues. Finality of decision has not been achieved for purposes of further appeal until the majority decision today. Hughes simply argues for our adherence to the law of the case.

There can be no question that the Supreme Court would apply the current law to a pending case. *See, e.g., United States Surgical Corp. v. Ethicon*, — U.S. ——, 116 S. Ct. 1562, 134 L.Ed.2d 662 (1996) (remanding case to apply ruling in *Markman v. Westview Instruments, Inc.*, 517 U.S. ——, 116 S. Ct. 1384, 134 L.Ed.2d 577 (1996) to case decided prior thereto). Therefore, it makes no sense to hold that this court should not apply current precedent to correct its decision in a pending case. If the law applied in *Hughes VII* is no longer the law in this circuit, this court has an obligation, under the principles of law of the case, to revisit that issue if failure to do so would work a manifest injustice.

B.

Nor should the passage of time work against the government's position. While *Hughes VII* was decided 14 years ago, the delay in the presentation of the issue of "law of the case" has not been due to the government's procrastination. Hughes's assertion that additional spacecraft infringed required extensive trials on

disparate issues, *e.g.*, whether some were held covered by a release to the manufacturer which they were. The government has not merely been "hoping that the passage of time or change in the composition of the court will provide a more favorable result the second time," as in a case cited by Hughes, *United States v. Turtle Mountain Band of Chippewa Indians*, 222 Ct. Cl. 1, 612 F.2d 517, 520 (1979). In that case the government sought reconsideration of an issue fully argued and rejected before. Hughes ellipses from the quotation, "No litigant deserves an opportunity to go over the same ground twice, hoping . . . [for a change in the court's view]." Here, the government argues that the law has been changed in *other cases* since the first decision.

IV.

It would be surprising, indeed, if no development of the law of infringement had occurred over the 14 years since *Hughes VII*, and one would have to bury one's head in the sand to hold it has not. Not only has the test for infringement been restated and refined as in the "All Elements rule" stated in *Pennwalt*, the rejection of functional equivalency as the test for infringement in *Atlanta Motoring Accessories, Inc. v. Saratoga Technologies, Inc.*, 33 F.3d 1362, 1366 (Fed. Cir.1994), and the "insubstantial change rule" set forth in *Hilton Davis*, discussed infra, but also the correct standards of review of a judgment of infringement were also later articulated for the first time.

Hughes argues that only an outright reversal of the substantive law applied in reaching a decision warrants departure from "law of the case." I find no controlling

authority so holding. If the law has evolved to such an extent that the result in the case would be different, law of the case principles do not require blind adherence to a wrong result. Conversely, if the result would be the same under current precedent, any error in a prior opinion would be harmless. This brings us to the question of what disposition should be made in this case of the S/E infringement issues.

The dissent in *Hughes VII* made the type of analysis which must be made under current case law. The actual structure of the specified components of the invention and of the accused devices was considered by the dissenter, not merely the overall equivalency or even the "equivalent" functions of the substituents, to which the majority limited its analysis. *Atlanta Motoring*, 33 F.3d at 1365-66 (merely functional equivalents not enough for infringement under doctrine); *Johnston v. IVAC Corp.*, 885 F.2d 1574, 1580, 12 USPQ2d 1382, 1387 (Fed. Cir.1989) (structual equivalency of "means" element required under § 112 ¶ 6). Further, the majority essentially performed a *de novo* review of the facts and law. The majority held no factual finding of the trial court clearly erroneous respecting the nonequivalency of the accused components, *Insta-Foam Prods., Inc. v. Universal Foam Sys., Inc.*, 906 F.2d 698, 702 (Fed. Cir. 1990) (determination of equivalent elements under the doctrine is a question of fact reviewed under clearly erroneous standard); it also did not remand for new factual findings after holding that the trial court erred "as a matter of law," *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1565, 1 USPQ2d 1593, 1595 (Fed. Cir. 1987) (in view of legal error, appellate court should remand for trial court to make the missing findings);

and it either ruled on equivalency as a matter of law contrary to *Hilton Davis*, 62 F.3d at 1522, 35 USPQ 2d at 1648 (finding of infringement under the doctrine of equivalents reviewed as a question of fact; not legal or equitable issue) or it substituted findings of *its own* that the different control system of the accused satellites was equivalent contrary to *Atlantic Thermoplastics Co. v. Faytex Corp.*, 5 F.3d 1477 (Fed.Cir.1993) ("fact-finding by the appellate court is simply not permitted"). Either way, the majority's free wheeling "review" was not in accord with the appellate standards now followed by this court.

V.

This court handed down a plethora of opinions in *Hilton Davis*. The majority says it merely "restated" the law by returning the doctrine to the original moorings of *Graver Tank* that only insubstantial changes from the claim fall within the doctrine. Three dissenting opinions and one concurrence were filed setting out widely divergent views of the law.

The Supreme Court has recently taken *Hilton Davis* for review, its first case on the doctrine of equivalents under the Patent Act of 1952. The petitioner therein urges that literal infringement (which includes equivalents only under 35 U.S.C. § 112 ¶ 6) should be the sole basis for liability and that the judicially created doctrine of equivalents should be abandoned because it is inconsistent with the current statute. Petitioner argues further that the test for nonliteral infringement set forth in *Hilton Davis*,[3] directed to the "insub-

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3 Contrary to statements by my colleagues, I do not advocate suspending other pending doctrine of equivalent cases. Such cases

stantiality of the differences" from the claimed invention, deprives the public of notice of patent boundaries, offers protection not approved by the PTO, and overrides the statutory reissue provisions. *Brief of Petitioner Warner-Jenkinson*, pp. 13-27. Petitioner urges the Court, at most, to recognize nonliteral infringement only where known equivalents are disclosed in the patent application, the situation in *Graver Tank*. *Brief of Petitioner Warner- Jenkinson*, at 38-41.

The Supreme Court's rulings on these issues can be expected to have a major impact on the law of infringement. I conclude that the majority opinion in *Hughes VII* conflicts not merely with the dissents in *Hilton Davis*, but with the majority as well. I would, therefore, suspend this appeal pending the Supreme Court's decision in *Hilton Davis*. A few months of delay is insignificant in a suit of this magnitude which has been pending since 1973. In my view, it would be a manifest injustice to the people of the United States to end this case and approve the payment of millions of dollars in compensation to Hughes when the law imposing liability is in a state of such uncertainty.

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should be decided in accordance with principles set forth in this court's majority decision in *Hilton Davis*. *Hughes VII* does not meet that test and raises the important issue of whether a substituent in the combination must have been a known equivalent. Without analysis, *Hughes VII* holds that later developed technology can be an infringing equivalent contrary to Supreme Court precedent, *see e.g., Halliburton Oil Well Cementing Co. v. Walker*, 329 U.S. 1, 13, 67 S. Ct. 6, 12, 91 L.Ed. 3 (1946).

APPENDIX F

UNITED STATES SUPREME COURT

No. 96-1297

UNITED STATES

v.

HUGHES AIRCRAFT CO.

April 21, 1997

Certiorari granted, judgment vacated, and case remanded for futher consideration in light of *Warner-Jenkinson Co.* v. *Hilton Davis Chemical Co., ante,* p. 17, Reported below: 86 F.3d 1566

APPENDIX G

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 94-5149, 95-5001

HUGHES AIRCRAFT COMPANY, PLAINTIFF-APPELLANT

v.

UNITED STATES, DEFENDANT-CROSS APPELLANT

July 28, 1998

ORDER

A combined petition for rehearing and suggestion for rehearing in banc having been filed by the Cross Appellant, and a response thereto having been invited by the court and filed by the Appellant, and the petition for rehearing having been referred to the panel that heard the appeal and thereafter the suggestion for rehearing in banc and response having been referred to the circuit judges who are in regular active service, and a poll whether to rehear the appeal in banc having been requested, taken, and failed, it is

ORDERED that the petition for rehearing be, and the same hereby is, DENIED; and it is further

ORDERED that the suggestion for rehearing in banc be, and the same hereby is, DECLINED.

Circuit Judge CLEVENGER dissents from the order declining the suggestion for rehearing in banc in a separate opinion, in which Circuit Judge GAJARSA joins.

Chief Judge MAYER did not participate.

The mandate of the court will issue on August 4, 1998.

CLEVENGER, Circuit Judge, dissenting from the Order declining the suggestion for rehearing in banc, in which Circuit Judge GAJARSA joins.

A petition for rehearing in banc filed by the United States carries with it the endorsement and urging of the Solicitor General, in addition to the weight of the department of the government that stands to lose in the case. In this case, the United States argues that this court has seriously misunderstood the Supreme Court's command in the celebrated case of *Warner- Jenkinson Co. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 117 S. Ct. 1040, 1049, 137 L.Ed.2d 146, 41 U.S.P.Q.2d 1865, 1871 (1997). According to the United States, the Supreme Court opinion in that case stated in blunt and clear words that, if a claim is amended during prosecution to secure a patent, then the patentee cannot assert the doctrine of equivalents as to the amended claim limitation. In this case, however, a panel of our court has held that the doctrine of equivalents *does* apply to amended claim limitations.

The words of the Supreme Court that support the position of the United States were identified and explained thoroughly by Judge Gajarsa in his opinion dissenting from our denial of a petition for rehearing in the *Litton* case. *See Litton Sys., Inc. v. Honeywell, Inc.*, 145 F.3d 1472, 1473-79, 47 U.S.P.Q.2d 1106, 1108-12 (Fed. Cir. June 18, 1998) (Gajarsa, J., dissenting from Order declining suggestion for rehearing in banc). In that case, I also expressed my chagrin that our court chose not to address the argument made now by the United States. *Id.* at 1472-74, 47 U.S.P.Q.2d at 1107-08 (Clevenger, J., dissenting from Order declining suggestion for rehearing in banc). Because a majority of my colleagues do not wish to listen to the United States in this case, I feel compelled to write on.

We have come a long way from the days when judges frowned on patents as pernicious monopolies deserving scant regard. Today, patents are the backbone of much of the national economy, and, as this court has recently held, virtually anything is patentable, *see State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368 (Fed.Cir.1998). This court has emphasized the requirement of clear and concise drafting of claims, and valid claims that are written properly are now enforced to the hilt. I think the Supreme Court understands this, for, in its *Warner-Jenkinson* opinion, it emphasized the cardinal significance of clear claim language, and highlighted the unwanted tension put on such claim language by a loosely applied doctrine of equivalents. I come away from the Supreme Court's opinion with the impression that the Court understands the mischief that the doctrine of equivalents can do to patent law. To counter such mischief, I think the Supreme Court meant to whittle the doctrine down in

size. As I recently explained, however, see *Litton Sys.*, *supra*, nothing in the *Warner-Jenkinson* opinion narrows the reach of the doctrine of equivalents, unless one accepts the reading of the opinion asserted by the United States in this case. In short, the United States thus should not give up on this case just because we deny its petition. Instead, the Solicitor General should ask the Supreme Court to grant a writ of certiorari in this case.

If the United States has misread the Supreme Court, the Court may let the panel's decision stand with a swift denial of the certiorari petition. If the United States is correct, the Supreme Court could grant the petition and might even correct our error per curiam. Cases involving the doctrine of equivalents continue to flow through the federal courts. The question posed by the United States in this case is of utmost importance to patent law. A swift answer to the question is needed. Therefore, it perhaps is wise of my colleagues to decline to spend the many months we would consume in rehearing this case, in favor of clearing the path for the Solicitor General to make his way to the best source for the answer to his question.

APPENDIX H

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 95-1242, 95-1311

LITTON SYSTEMS, INC., PLAINTIFF-APPELLANT

v.

HONEYWELL, INC., DEFENDANT-CROSS APPELLANT

April 7, 1998

Before NEWMAN, RADER, and BRYSON, Circuit Judges.

Opinion for the court filed by Circuit Judge RADER. Opinion concurring in part and dissenting in part filed by Circuit Judge PAULINE NEWMAN.

RADER, Circuit Judge.

The United States Supreme Court vacated the judgment in *Litton Systems, Inc. v. Honeywell, Inc.*, 87 F.3d 1559, 39 USPQ2d 1321 (Fed. Cir. 1996) (*Litton I*), and remanded to this court for further consideration in light of *Warner-Jenkinson Co. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146 (1997). *See Honeywell, Inc. v. Litton Sys., Inc.*, —— U.S. ——, 117 S. Ct. 1240, 137 L.Ed.2d 323 (1997). After applying the principles of *Warner-Jenkinson*, this court affirms-in-part, reverses-in-part, vacates-in-part, and remands.

Effect of Vacatur

This court first considered an appeal by Litton, Inc. (Litton), from a decision of the United States District Court for the Central District of California. After a jury verdict in favor of Litton, the trial court granted in-part Honeywell, Inc.'s (Honeywell's) motion for judgment as a matter of law (JMOL). The district court determined that: (1) Honeywell's hollow cathode process did not literally infringe Litton's U.S. Patent No. Re. 32,849 (the '849 reissue), but upheld the jury's verdict of infringement under the doctrine of equivalents; (2) Honeywell's radio frequency (RF) ion beam process did not infringe, either literally or under the doctrine of equivalents, the '849 reissue; (3) the '849 reissue was invalid for obviousness; (4) Litton did not prove its claims of intentional interference with contractual relations and intentional interference with prospective economic advantage under state law; (5) inequitable conduct precluded enforcement of the '849 reissue; and (6) the doctrine of intervening rights applied. *See Litton Sys., Inc. v. Honeywell, Inc.*, 1995 WL 366468 (C.D. Cal. 1995). In the alternative, the trial court granted Honeywell's motion for a new trial on damages, but not liability. *See id.*

In *Litton I*, this court reversed the trial court's grant of JMOL. This court determined that: (1) substantial evidence supported the jury's findings that Honeywell's hollow cathode and RF processes infringed the '849 reissue; (2) the '849 reissue was neither invalid for obviousness nor unenforceable for inequitable conduct; and (3) substantial evidence supported the jury's finding of Honeywell's liability under both state law claims. *See Litton I*, 87 F.3d at 1559. *Litton I* also

affirmed the trial court's grant of a new trial on damages and its order on intervening rights. *See id.*

Litton's patents claim a method for coating a substrate with multiple layers of optical materials. The method uses an ion beam from a Kaufman-type ion beam source to sputter deposit the optical materials on the substrate. The result is an almost perfectly reflective mirror, an essential component for ring-laser gyroscopes (RLGs). RLGs control navigation in aircraft. Honeywell's alleged infringing methods for making these mirrors use ion beams from hollow cathode and RF ion beam sources. *Litton I*, 87 F.3d at 1563-66, gives a more detailed discussion of the factual background of the case.

Because *Warner-Jenkinson* addressed the doctrine of equivalents, particularly the application of prosecution history estoppel, this court reinstates, without further analysis, the parts of *Litton I*: (1) reversing the trial court's grant of JMOL with respect to the invalidity of the '849 reissue on grounds of obviousness; (2) reversing the determination of unenforceability for inequitable conduct; (3) affirming the intervening rights order; and (4) affirming the grant of a new trial on damages (if liability is found on remand for any or all of the federal and state law claims). The Supreme Court's opinion in *Warner-Jenkinson* does not affect these aspects of *Litton I*. *See Syntex Ophthalmics, Inc. v. Novicky*, 767 F.2d 901, 902, 226 USPQ 952, 952 (Fed. Cir. 1985).

This court applies the doctrines of *Warner-Jenkinson* to the remaining issues. The standard of review with respect to the remaining issues remains unchanged. *See, e.g., Martin v. Telectronics Pacing Sys., Inc.*, 105

F.3d 1090, 1092 (6th Cir. 1997), *cert. denied*, —— U.S. ——, 118 S. Ct. 850, 139 L.Ed.2d 751 (1998).

Claim Construction

In this case, the question of infringement turns primarily on the interpretation of the phrase "Kaufman-type ion beam source" in claim 1 of the '849 reissue. Litton contends that the appropriate interpretation of "Kaufman-type ion beam source" encompasses any broad-beam, multi-apertured, gridded ion beam source. Litton's proposed construction, however, is inconsistent with the prosecution history of the '849 reissue. *See York Prods., Inc. v. Central Tractor Farm & Family Ctr.*, 99 F.3d 1568, 1575, 40 USPQ2d 1619, 1624 (Fed. Cir. 1996) ("In a literal infringement analysis, prosecution history is relevant to claim coverage."); *see also Howes v. Medical Components, Inc.*, 814 F.2d 638, 645-46, 2 USPQ2d 1271, 1275-76 (Fed. Cir. 1987).

In the course of prosecuting the '849 reissue, Litton argued that the term "ion beam source" in its original claims could not "properly be construed to refer to any other ion beam gun but the Kaufman gun." Paper No. 15 at 8. Moreover, a declaration accompanying Litton's remarks plainly stated: "Those skilled in the coating arts . . . would reasonably construe these claims to refer . . . only to the Kaufman-type ion-beam guns referred to in the specification of this application." Paper No. 16 at 7. Thus, Litton defined "ion beam source" to mean only the Kaufman-type gun. This definition acquires even more credibility when Litton later amended its claims to cover a "Kaufman-type ion beam source." If, as Litton insisted, one of skill could only construe the broad term to mean a Kaufman-type gun, certainly the specific term encompasses nothing more.

At column 4, lines 44-57, the reissue's specification describes a Kaufman-type ion beam source:

> The ion beam gu[n] 4 is a commercially available ion [e]mitting ap[p]aratus generally known in the art as a *Kauffman [sic] type ion beam gun.* The gun's *cathode 6 is a therm[i]onic emitter*, i.e., it emits electrons by passing an electric current through it which heats the wire. The cathode 6 emits electrons which are accelerated towards the *anode* 8. The electrons being accelerated from the cathode to the anode strike argon atoms and in so doing dislodge electrons from the argon. The results are positively charged argon ions which are accelerated away from the anode and towards the *grids* 12 and 14. Permanent bar *magnets* 10 attached to the anode introduce a magnetic field into the area between the cathode and the anode. . . .

(Emphasis added.) Thus, this court interprets the phrase "Kaufman-type ion beam source" to include a thermionic (hot-wire) cathode, an anode, grids, and magnets.

This court detects no legally significant distinction between the phrases, "Kaufman-type ion beam source" and "Kaufman-type ion beam gun." During the prosecution of the reissue, Litton used the terms "gun" and "source" interchangeably. For example, in response to one of the examiner's rejections, Litton stated: "Applicants need not add the words 'Kaufman gun' or 'Kaufman source' to claim 1 because claim 1 cannot properly be construed to refer to any other ion beam gun but the Kaufman gun." Paper No. 15 at 8.

In sum, after consideration of the primary sources for construing patent claim meaning, this court interprets

the phrase "Kaufman-type ion beam source" to encompass any ion beam gun with the four stated components: a hot-wire cathode, an anode, grids, and magnets.

Literal Infringement

Literal infringement requires that the accused device contain each limitation of the claim exactly; any deviation from the claim precludes a finding of literal infringement. *See Cole v. Kimberly-Clark Corp.*, 102 F.3d 524, 532, 41 USPQ2d 1001, 1007 (Fed. Cir. 1996), *cert. denied*, —— U.S. ——, 118 S. Ct. 56, 139 L.Ed.2d 20 (1997). Because Honeywell's hollow cathode process does not employ a hot-wire cathode and its RF ion beam process does not use a cathode at all, this court affirms the trial court's grant of JMOL that the accused hollow cathode and RF ion beam processes do not literally infringe the asserted claims of the '849 reissue.

Infringement Under the Doctrine of Equivalents

Because Honeywell's processes do not literally infringe Litton's claimed method, this court now considers the issue of infringement under the doctrine of equivalents. Litton asserts that Honeywell's hollow cathode and RF ion beam sources are equivalents of the "Kaufman-type ion beam source" in claim 1. Honeywell contends that they are not equivalents, and, more importantly, that Litton's admissions and amendments during patent prosecution estop it from asserting any equivalents to the "Kaufman-type ion beam source."

In reconciling the uncertainty surrounding application of the doctrine of equivalents with the definitional and public-notice functions of the statutory claiming requirement, the Supreme Court endorsed an element-by- element analytical framework for infringement. *See*

Warner-Jenkinson, 520 U.S. at ——, 117 S. Ct. at 1049; *see also Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 935, 4 USPQ2d 1737, 1741 (Fed. Cir. 1987) (in banc). In this framework, "[e]ach element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole." *Warner-Jenkinson*, 520 U.S. at ——, 117 S. Ct. at 1049. In applying this method, the Court cautioned against a range of equivalents with "such broad play as to effectively eliminate that element in its entirety." *Id.* The essential inquiry is whether "the accused product or process contain[s] elements identical or equivalent to each claimed element of the patented invention." *Id.* at ——, 117 S. Ct. at 1054.

As discussed above, the "Kaufman-type ion beam source" phrase means a source with a hot-wire cathode, an anode, grids, and magnets. The jury's special verdict form indicates that it adopted a construction of "Kaufman-type ion beam source" as "[a]ny broad-beam, multiapertured, gridded ion beam source, which includes any hollow cathode gun and any radio frequency gun." Therefore, the jury based its finding of infringement under the doctrine of equivalents on an erroneous claim construction.

Under an element-by-element analysis, an error in claim construction propagates into the jury's equivalence determination. The fact finder must determine whether a specific feature of the accused device or process is equivalent to a given claim element, as properly construed. Due to reliance on an erroneous claim construction, this court vacates the jury's verdict on the

issue of infringement under the doctrine of equivalents for both the hollow cathode and RF processes.

This same claim interpretation error cannot be found, however, in the district court's grant of JMOL that Honeywell's RF source could not infringe under the doctrine of equivalents. The district court adopted an interpretation of the "Kaufman-type ion beam source" identical to that which this court has adopted. In denying infringement under the doctrine of equivalents, the district court reasoned—despite evidence of interchangeability and insubstantial differences—that the "Kaufman-type ion beam source" limitation could not embrace a range of equivalents that extended to a source that worked in a substantially different way. *See* 1995 WL 366468 at *46; *Litton I*, 87 F.3d at 1572.

In light of the additional clarification supplied by case law in the intervening period, this court vacates the district court's grant of JMOL to allow it to consider other rationales for judgment as a matter of law—for both the hollow cathode and RF processes. Specifically, this court provides the district court an opportunity to consider: (1) whether, as outlined below, prosecution history estoppel precludes infringement under the doctrine of equivalents, (2) whether prior art precludes infringement under the doctrine of equivalents, *see General Am. Transp. Corp. v. Cryo-Trans, Inc.*, 93 F.3d 766, 771, 39 USPQ2d 1801, 1804 (Fed. Cir. 1996), *cert. denied*, —— U.S. ——, 117 S. Ct. 1334, 137 L.Ed.2d 493 (1997); *Wilson Sporting Goods Co. v. David Geoffrey & Assocs.*, 904 F.2d 677, 684, 14 USPQ2d 1942, 1948 (Fed. Cir. 1990), and (3) whether, under the reasoning of *Warner-Jenkinson*, application of the doctrine of equivalents would "effectively eliminate [an] element in its entirety," *Warner-Jenkinson*, 520 U.S. at ——, 117

S. Ct. at 1049. In sum, this court remands to permit examination of the application of the doctrine of equivalents.

Prosecution History Estoppel

In *Warner-Jenkinson*, the Supreme Court changed some aspects of the law of prosecution history estoppel. However, the extent of this change was limited. Honeywell argues that *Warner-Jenkinson* held that if a claim element has been added by amendment for reasons of patentability, prosecution history estoppel automatically bars all equivalents for that element, regardless of whether the administrative record before the Patent and Trademark Office (PTO) shows that the applicant surrendered all coverage beyond the literal claim scope. Honeywell's position, however, would both bar after-arising equivalents expressly approved by the Supreme Court and bar any equivalents whatsoever to the vast majority of claim limitations amended during patent prosecution.

This court determines in this opinion that the Supreme Court did not in fact effect such a sweeping change. Instead the Supreme Court adhered to the longstanding doctrine that an estoppel only bars recapture of that subject matter actually surrendered during prosecution. The common practice of amending a claim during prosecution, even amending to overcome prior art, does not necessarily surrender all subject matter beyond the literal scope of the amended claim limitation.

In *Warner-Jenkinson*, the Supreme Court first rejected several arguments for negation of the doctrine of equivalents. *See* 520 U.S. at ——- - ——, 117 S. Ct. at 1047-48. Next the Court considered doctrines which

restrain application of the doctrine. *See id.* at —— - ——, 117 S. Ct. at 1049-51. At this juncture, the Court discussed the "well-established limit on non-literal infringement, known variously as 'prosecution history estoppel' and 'file wrapper estoppel.'" *Id.* at ——, 117 S. Ct. at 1049. The Court noted: "In each of our cases . . . prosecution history estoppel was tied to amendments made to avoid the prior art, or otherwise to address a specific concern—such as obviousness. . . ." *Id.* Thus, the Court reaffirmed that the reason for claim amendments remains relevant to application of an estoppel. *See id.* at ——, 117 S. Ct. at 1050. A claim amendment to avoid prior art prevents recapture of subject matter the applicant surrendered to obtain patent protection. "Where the reason for the [claim] change was not related to avoiding the prior art . . . [the prosecution history] does not necessarily preclude infringement by equivalents. . . ." *Id.* at —— - ——, 117 S. Ct. at 1050-51. The Supreme Court thus noted that an amendment during prosecution does not foreclose all application of the doctrine of equivalents. Rather a court must inquire into the reasons for an amendment before invoking an estoppel.

In *Warner-Jenkinson*, however, the patent prosecution record disclosed no reason for Hilton Davis's claim amendments. *See id.* at ——, 117 S. Ct. at 1051. In this context, the Court established a presumption that when an applicant narrows a claim element during prosecution, a trial court should presume that the applicant did so for a reason related to patentability. *See id.* Consequently, where a patent owner cannot show a reason for the amendment other than patentability, "a court should presume that the purpose behind the . . . amendment is such that prosecution history estoppel

would apply." *Id.* at ——, 117 S. Ct. at 1054. Thus, the Supreme Court articulated an additional rule to trigger, in applicable circumstances, prosecution history estoppel. But that is all the Supreme Court articulated. Although *Warner-Jenkinson* supplied new guidance about when prosecution history estoppel might apply, the Court did not change the scope or effect of the estoppel.

In accord with the Supreme Court's understanding, this court has repeatedly stated that application of prosecution history estoppel does not necessarily limit a patentee to the literal language of the amended element—even when an amendment has been made to overcome the prior art. *See LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 867 F.2d 1572, 1575-76, 9 USPQ2d 1995, 1998-99, (Fed. Cir. 1989) (reversing an administrative law judge's ruling otherwise); *Dixie USA, Inc. v. Infab Corp.*, 927 F.2d 584, 588, 17 USPQ2d 1968, 1970-71 (Fed. Cir. 1991) (confirming that as a general principle, "a total preclusion of equivalence should not apply"). Thus, an amendment to claim language in response to prior art "may have a limiting effect within a spectrum ranging from great to small to zero. The effect may or may not be fatal to application of a range of equivalents broad enough to encompass a particular accused product. It is not fatal to application of the doctrine itself." *Hughes Aircraft Co. v. United States*, 717 F.2d 1351, 1363, 219 USPQ 473, 481 (Fed. Cir. 1983); *see also Modine Mfg. Co. v. United States Int'l Trade Comm'n*, 75 F.3d 1545, 1555-56, 37 USPQ2d 1609, 1616 (Fed. Cir.), *cert. denied*, 518 U.S. 1005, 116 S. Ct. 2523, 135 L.Ed.2d 1048 (1996).

Despite the Supreme Court's overall reasoning, Honeywell argues that *Warner-Jenkinson* eliminated any scope for prosecution history estoppel. In other words, according to Honeywell, any claim language amended during prosecution for reasons related to patentability has no range of equivalents. To support its transformation of infringement rules, Honeywell points to the following language:

> Where no explanation is established, however, the court should presume that the PTO had a substantial reason related to patentability for includeing the limiting element added by amendment. In those circumstances, *prosecution history estoppel would bar the application of the doctrine [sic] equivalents as to that element.*

Warner-Jenkinson, 520 U.S. at ——, 117 S. Ct. at 1051 (emphasis added).

Read in context, this passage does not effect the sweeping change advocated by Honeywell. As noted above, the entire context of the *Warner-Jenkinson* opinion shows that the Supreme Court approved the PTO's practice of requesting amendments with the understanding that the doctrine of equivalents would still apply to the amended language. As noted above, this court had repeatedly articulated that rule. In that context, it is telling that the Supreme Court was careful to avoid disturbing basic rules and assumptions. Footnotes 6 and 7 further evince an intent "[t]o [not] change so substantially the rules of the game." *Warner-Jenkinson*, 520 U.S. at —— n. 6, 117 S. Ct. at 1050 n. 6. Footnote 6 appears to explain further the Court's rejection of the petitioner's proposed any-type-of-amendment, no-equivalents rule. Footnote 7 explains that "where a change is made to overcome an objection

based on the prior art," a court should explore "the reason (right or wrong) for the objection and the manner in which the amendment addressed and avoided the objection." *Id.* at ——, 117 S. Ct. at 1051 n. 7. These footnotes evince the Court's intent to change as little as possible.

Also, the accumulated case law of the Supreme Court and this court on the scope of prosecution history estoppel contradict Honeywell's reading of a single isolated sentence. For example, *Keystone Driller Co. v. Northwest Engineering Corp.*, 294 U.S. 42, 47-48, 55 S. Ct. 262, 264-65, 79 L.Ed. 747 (1935), and *Smith v. Magic City Kennel Club*, 282 U.S. 784, 788-90, 51 S. Ct. 291, 293-94, 75 L.Ed. 707 (1931), cited by the *Warner-Jenkinson* Court, acknowledge the concept that an estoppel has an appropriate scope. In both cases, the Court inquired into the scope of the original claim and the prior art before estopping the patentee from asserting the equivalence of a particular feature of the accused device. If an amendment related to patentability automatically precluded all equivalents to the amended language, the Court's inquiry would have been irrelevant.

Honeywell's interpretation also reads too narrowly the Supreme Court's endorsement of "after-arising equivalents." The Supreme Court expressly rejected the argument that the doctrine of equivalents should be limited to equivalents that are disclosed within the patent itself or equivalents known at the time the patent was issued. *See Warner-Jenkinson*, 520 U.S. at —— - ——, 117 S. Ct. at 1052-53. Nowhere did the Supreme Court suggest that such after-arising equivalents would be barred as a matter of law whenever a claim is amended to overcome prior art before the

examiner. Such an interpretation is also inconsistent with the Supreme Court's admonition that a "brighter line for determining whether a patentee is estopped under certain circumstances is not a sufficient reason for adopting such a rule." *Id.* at —— n. 6, 117 S. Ct. at 1050 n. 6.

Finally, the Supreme Court did not find an estoppel based on the record before it, but remanded to this court, which, in turn, remanded to the district court for fact finding on application of the presumption. Therefore, the Supreme Court did not reach the question of the proper scope of estoppel for an amended limitation. In sum, a careful reading of the Supreme Court's opinion in context shows that *Warner-Jenkinson* did not effect a change in the scope of subject matter precluded by an estoppel, but only in the circumstances that may trigger an estoppel.

The Supreme Court began its discussion of prosecution history estoppel by acknowledging that in each of its cases estoppel "was tied to amendments made to avoid the prior art, or otherwise to address a specific concern—such as obviousness—that arguably would have rendered the claimed subject matter unpatentable." *Warner-Jenkinson*, 520 U.S. at ——, 117 S. Ct. at 1049. Thus, from the outset, the Court recognized that the *Warner-Jenkinson* standard "related to patentability" encompassed amendments "made to avoid the prior art." The Court then observed:

> It is telling that in each case this Court probed the reasoning behind the Patent Office's insistence upon a change in the claims. In each instance, a change was demanded because the claim as otherwise written was viewed as not describing a patentable

> invention at all—typically because what it described was encompassed within the prior art.

Id. at ——, 117 S. Ct. at 1050.

The Supreme Court then proceeded to recognize that "there are a variety of other reasons why the PTO may request a change in claim language." *Id.* For this proposition, the Court cited the United States' amicus brief, which refers to amendments made to overcome indefiniteness and nonenablement rejections. *See* Brief for United States as Amicus Curiae at 22-23, *Warner-Jenkinson*, —— U.S. ——, 117 S. Ct. 1040 (1997) (No. 95-728), *available in* 1996 WL 172221. Thus, the Court concluded, "[o]ur prior cases have consistently applied prosecution history estoppel only where claims have been amended for a limited set of reasons, and we see no substantial cause for requiring a more rigid rule invoking an estoppel regardless of the reasons for a change." *Warner-Jenkinson*, 520 U.S. at ——, 117 S. Ct. at 1050.

Although not automatically erecting an estoppel, an amendment made for reasons other than patentability may still give rise to an estoppel. This court has acknowledged that even arguments made during prosecution without amendments to claim language—if sufficient to evince a clear and unmistakable surrender of subject matter—may estop an applicant from recapturing that surrendered matter under the doctrine of equivalents. *See Hoganas AB v. Dresser Indus., Inc.*, 9 F.3d 948, 952, 28 USPQ2d 1936, 1939 (Fed.Cir.1993). Estoppel by clear and unmistakable surrender without claim amendments may arise even when the arguments to the examiner were not necessary to distinguish prior art. *Texas Instruments Inc. v. United States Int'l Trade Comm'n*, 988 F.2d 1165, 1174-75, 26 USPQ2d

1018, 1025 (Fed.Cir.1993). This principle presupposes that the applicant has made the surrender unmistakable enough that the public may reasonably rely on it. By logical extension, if an applicant makes an amendment unrelated to patentability which evinces an unmistakable surrender, that action will preclude recapture of the surrendered subject matter under the doctrine of equivalents.

Prosecution History of the '849 Reissue

Turning to application of the doctrine of prosecution history estoppel in this case, this court first recognizes that Litton amended its claims. The applicant amended claim 1 to add language about the "Kaufman-type ion beam source." Thus, this court must examine whether that amendment occurred for a reason related to patentability. The applicant filed the '849 reissue on July 2, 1985. At that time, independent claim 1 read as follows:

> 1. A method of fabricating multiple layer optical films, said multiple layer optical films comprising optical layers having different indices of refraction comprising:
>
> bombarding targets obliquely with *an ion beam* in a vacuum chamber to sputter deposit a plurality of optical film layers on a base;
>
> controlling the atmosphere inside the vacuum chamber to provide sufficient gas to sustain the ion beam and the proper amount of oxygen to accomplish proper stoichiometry of the thin films; and

depositing multiple layers of different materials on said base by varying the targets being bombarded by the ion beam; and

continuously rotating said base during the deposition of said multiple optical layers.

(Emphasis added.) In the next month, August 1985, Litton submitted a patentability report citing eighty-two references. Litton took pains to separately list and distinguish each of these references. Often Litton explained that a given reference "does not disclose Applicant's [Litton's] claimed ion beam sputtering techniques." The list of references included an article by G.E. Lane and J.C. Anderson, "The Nucleation and Initial Growth of Gold Films Deposited onto Sodium Chloride by Ion-Beam Sputtering," that appeared in *Thin Solid Films* in 1975. The Lane and Anderson (Lane) article disclosed RF ion beam sputtering of gold films onto substrates at low deposition rates.

In October 1985, one of Litton's competitors filed a protest under 37 C.F.R. § 1.291 (1985). The protest highlighted two references: (1) an article by W. Laznovsky entitled "Advances in Low Energy Ion Beam Technology," in *Research/Development* in 1975; and (2) French Patent No. 2,129,996, whose counterpart issued in 1975 as U.S. Patent No. 3,925,187 to Bernard. The Laznovsky article described a device for ion beam sputtering deposition with a rotating target in an atmosphere controlled for oxygen loss. The Bernard patent was included in the patentability report and disclosed an apparatus for forming multiple layer coatings on microelectronic or semiconductor devices with a duoplasmatron ion beam. The protest for the

first time brought Laznovsky to the examiner's attention.

In December 1985, after receipt of the protest, the examiner rejected all the claims as obvious under section 103. In addition to extensive reliance on the Laznovsky article, the examiner rejected the claims "under 35 U.S.C. 103 as . . . unpatentable over the combination of admitted prior art contained in [the] 'Patentability Report.'" *See* Paper No. 6.

In its June 1986 response, Litton acknowledged that all the prior art in the patentability report, as well as the Laznovsky article, occasioned the obviousness rejection. Paper No. 10 at 4-5. Indeed Litton again a second time listed by number each of the eighty-two references previously cited along with the Laznovsky article and expressly distinguished its claims from each piece of prior art. Beyond the express reference-by-reference distinctions, Litton further distinguished the invention from these eighty-three references as follows:

> What is novel and unobvious about Applicants' invention is the use of ion-beam sputtering techniques, *and particularly the use of Kaufman gun ion beam techniques*, to form multiple-layer optical films on a base with optical layers having different indices of refraction. . . .

Id. at 5 (emphasis added). At this point, Litton also included for the first time its "Kaufman-type" limitation in several dependent claims.

Nonetheless, the examiner issued a final rejection again under section 103 on July 3, 1986. The examiner focused on one ion beam source in the prior art—the duoplasmatron source of the Bernard patent. The rejection highlighted the discontinuity between the

claims' general requirement for an "ion beam source" and Litton's arguments directed to a more narrow "Kaufman-type ion beam source":

> As for applicants' arguments based upon an alleged unexpected result obtained by use of a Kauffman [sic] type ion gun rather than a duoplasmatron type ion gun, it is noted that most of the claims are not limited to any particular type of ion gun; thus applicants are arguing a limitation not in the claims. Moreover, Kauffman [sic] type ion sources are standard in the art; their use in ion beam sputtering apparatus constitutes nothing unobivous [sic]. See e.g. Laznovsky at page 47, column 1. Lastly, applicants merely allege an unexpected result; no comparative data are supplied.

Paper No. 11 at 6. In conclusion, the examiner again a second time rejected Litton's claims "over the combination of references as made in the first Office action." In rejecting again over all eighty-three references, the examiner pointed out as noted above that Litton had not limited its claims "to any particular type of ion gun."

In December 1986, Litton replied: "Contrary to the contentions in Paper No. 11, Applicants' claims relate only to Kaufman-type ion-beam sputtering because duoplasmatron sources are today, and were in 1978, devices that no one of ordinary skill in the art would use for forming multiple layer optical coatings." Paper No. 15 at 7. Litton argued that the examiner had read claim 1 broadly to include duoplasmatron ion beam sources when it "[could not] properly be construed to refer to any other ion beam gun but the Kaufman gun." *Id.* at 8.

In addition, Litton submitted three declarations under 37 C.F.R. § 1.132 supporting its nonobviousness contentions. These declarations highlighted the unexpected results from the Kaufman-type guns and the slow deposition rates of the duoplasmatron. In particular, the Baumeister declaration contended:

> Those skilled in the coating arts, in reading claims 1 and 3-10 of this application for reissue, knowing that duoplasmatron sources are unworkable for making multiple layer optical coatings of any kind, let alone the multiple layer optical coatings referred to in claims 1 and 3-10, would reasonably construe these claims to refer not to duoplasmatron sputtering sources, but only to the Kaufman-type ion-beam guns referred to in the specification of this application.

Paper No. 16 at 7. Baumeister also included as an exhibit a chapter of James M.E. Harper's *Thin Film Processes*, entitled "Ion Beam Deposition" and published in 1978. The Harper chapter discussed several ion beam sources, particularly the Penning, Kaufman, and hollow cathode ion beam sources.

Recognizing that the examiner had rejected over all eighty-three references, however, Litton again a third time cited and individually distinguished each of the cited references. Indeed for emphasis, Baumeister also resubmitted all eighty-three references with his declaration as evidence that he had considered and distinguished the relevant prior art.

Apparently, the declarations persuaded the examiner. After a January 1987 telephone communication, he made the following notes:

> The examiner initiated the interview to inform applicant's attorney that allowance of the application was possible if all the claims were limited to Kaufman gun sources being used in the claimed process. Unless the claims were so limited, the examiner indicated that a 35 U.S.C. 112 Par 2 rejection[,] on the basis that applicants were not claiming what they regarded as their invention in view of their argument contained in paper no. 15 filed 12/16/86[,] would be made in the next office action on the merits. The paper # 15 overcomes the other previously made objections.

Paper No. 17. Thus, at this point, the examiner conditioned allowance of the claims on an amendment limiting the invention to Kaufman gun sources.

In its March 1987 response, Litton treated the examiner's threat as a formal section 112 rejection. Litton incorporated the Kaufman-type ion beam source limitation into claim 1 (the "Kaufman-type amendment"), stating that the amendment was made "to overcome the rejections of these claims under 35 USC § 112, second paragraph." With this action, Litton submitted for still a fourth time all eighty-three references and a number-by-number explanation of the distinctions between its invention and each of those references.

The examiner allowed the amended claims and closed prosecution on the merits on June 26, 1987. Claim 1, as amended, read as follows:

> 1. A method of fabricating multiple layer optical films, said multiple layer optical films comprising optical layers having different indices of refraction comprising:

bombarding targets obliquely with an ion beam *produced by or derived from a Kaufman-type ion beam source* in a vacuum chamber to sputter deposit a plurality of optical film layers on a base;

controlling the atmosphere inside the vacuum chamber to provide sufficient gas to sustain the ion beam and the proper amount of oxygen to accomplish proper stoichiometry of the thin films; and

depositing multiple layers of different materials on said base by varying the targets being bombarded by the ion beam; and

continuously rotating said base during the deposition of said multiple optical layers.

(Emphasis added.) Claim 1 is representative of the other claims; wherever the phrase "an ion beam" had appeared, Litton substituted "an ion beam produced by or derived from a Kaufman-type ion beam source."

Even this action, however, did not complete the prosecution history. After another technical examiner interview in April 1987, Litton submitted again the entire list of the eighty-three references complete with distinctions from its invention. This final June 1987 submission was the fifth time (sixth counting the Baumeister declaration) that Litton had raised and expressly distinguished its invention from each of the eighty-three references. At that point, an inequitable conduct investigation began. The investigation ended just before issuance of the '849 reissue on January 31, 1989.

Effect of the Kaufman-type Amendment

In view of the foregoing prosecution history, this court now considers whether the Kaufman-type amendment was related to patentability. Litton argues that the amendment came after the applicants had "overcome the other previously made [obviousness] rejections." Paper No. 17 at 1. Litton characterizes its amendment as a response to a rejection under 35 U.S.C. § 112, ¶ 2 because the "applicants were not claiming what they regarded as their invention." *Id.* Litton cites *Warner Jenkinson* for the proposition that amendments in response to section 112 rejections are not related to patentability. Because its amendment responded to a section 112 rejection, Litton argues that its amendment was not "related to patentability" and this court should not presume that the amendment created an estoppel.

Although amendments made in response to indefiniteness and enablement rejections are generally not made "in response to the prior art," the amendment made in response to the section 112 rejection at issue here, a "regards as his invention" rejection, was related to patentability. Without evidence to the contrary, an examiner generally should presume that a claim recites what the applicant regards as his invention. *See In re Moore*, 58 C.C.P.A. 1042, 439 F.2d 1232, 1235, 169 USPQ 236, 238 (CCPA 1971). Moreover, "some material submitted by [the] applicant, *other than his specification*" must warrant this type of section 112 rejection. *In re Conley*, 490 F.2d 972, 976, 180 USPQ 454, 457 (CCPA 1974). Thus, an examiner generally makes a "regards as his invention" rejection only as an applicant's position becomes clear over the course of prosecution. In other words, this rejection almost

always follows some other rejection of the inventive material set forth in the claim. *See, e.g., In re Prater*, 56 C.C.P.A. 1381, 415 F.2d 1393, 162 USPQ 541 (CCPA 1969) (followed section 101 non-statutory subject matter rejection).

Consequently, this court cannot ignore the rejections which preceded this "regards as his invention" rejection. This particular "regards as his invention" rejection followed a series of obviousness rejections. In effect, the examiner threatened to reject again for obviousness unless the applicant restated its claim to match the scope of its narrow arguments for patentability. In this context, the section 112 rejection carried the same message as the prior obviousness rejection. An obviousness rejection is of course made in response to prior art. Consequently, this court determines that Litton made its amendment for reasons related to patentability.

Scope of the Estoppel

Because Litton's amendment was made for reasons related to patentability, prosecution history estoppel applies to the phrase "Kaufman-type ion beam source." As previously indicated, however, estoppel does not bar Litton from invoking the doctrine of equivalents altogether with respect to the "Kaufman-type ion beam source" limitation. Accordingly, this court now considers the scope of what Litton actually surrendered.

As a basic proposition, the standard for determining whether subject matter has been relinquished is whether one of ordinary skill in the art would objectively conclude from the prosecution history that an applicant surrendered it. *See Mark I Mktg. Corp. v. R.R. Donnelley & Sons Co.*, 66 F.3d 285, 291, 36

USPQ2d 1095, 1100 (Fed. Cir. 1995). As noted earlier, either amendments or arguments made by an applicant may be the basis for this conclusion.

When prosecution history estops a patentee, the court ascertains the scope of the estoppel in several ways. First, "a patentee is estopped from recovering through equivalency that which was deemed unpatentable in view of the prior art." *Pall Corp. v. Micron Separations, Inc.*, 66 F.3d 1211, 1219 (Fed. Cir. 1995). In other words, when an applicant, in response to an examiner's prior art rejection, amends a claim by substituting one limitation for another, the applicant cannot later assert that the original limitation is an equivalent of the substituted limitation. Thus, the doctrine prevents the applicant from *completely* recapturing the subject matter rejected by the examiner.

In addition, when an applicant narrows a claim element in the face of an examiner's rejection based on the prior art, the doctrine estops the applicant from later asserting that the claim covers, through the doctrine of equivalents, features that the applicant amended his claim to avoid A patentee is also estopped to assert equivalence to "trivial" variations of such prior art features. *See Southwall Techs., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1580, 34 USPQ2d 1673, 1680 (Fed. Cir. 1995). Depending on the facts of the case, an amendment may also limit the patentee to its literal claim scope. *See Wang Lab., Inc. v. Toshiba Corp.*, 993 F.2d 858, 867-68, 26 USPQ2d 1767, 1775-76 (Fed. Cir. 1993); *Wang Lab., Inc. v. Mitsubishi Elecs. America*, 103 F.3d 1571, 1577-78, 41 USPQ2d 1263, 1268-69 (Fed. Cir. 1997).

In addition, as noted earlier, an applicant's arguments may constitute a clear and unmistakable surrender of subject matter. Such arguments preclude recapture of that subject matter. *See Texas Instruments*, 988 F.2d at 1174-75 (holding that applicants had clearly represented that "same-side gating" did not work and could not be asserted as an equivalent). As noted above, this type of estoppel can arise regardless of the *Warner-Jenkinson* presumptions. *See ante* at —— - ——. Of course, applicants commonly make arguments in combination with an amendment, as in this case. In such circumstances, the scope of estoppel is a product of the effects of both factors working in concert.*

According to these principles, Litton's conduct clearly estops it from asserting that a duoplasmatron source is equivalent to a "Kaufman-type" source. This estoppel falls within one of the categories mentioned above—an amendment which narrows a claim element to avoid prior art. Duoplasmatron sources were in the prior art specifically cited by the examiner in his rejection of claim 1. In response, Litton narrowed its

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* Contrary to the suggestions in the dissenting opinion, it is not necessary that a reference be specifically cited by the examiner as the reason for a rejection in order for it to give rise to an estoppel. Arguments made by an applicant in an information disclosure statement or otherwise during prosecution may form the basis of an estoppel without regard to whether the argument was made in response to a rejection or the prior art was cited by the examiner. *See Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1575, 41 USPQ2d 1961, 1969 (Fed .Cir. 1997); *Ekchian v. Home Depot, Inc.*, 104 F.3d 1299, 1304, 41 USPQ2d 1364, 1368 (Fed. Cir. 1997); *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 988 F.2d 1165, 1174, 26 USPQ2d 1018, 1025 (Fed. Cir. 1993); *Coleco Indus., Inc. v. United States Int'l Trade Comm'n*, 65 C.C.P.A. 105, 573 F.2d 1247, 1256-57, 197 USPQ 472, 479-80 (CCPA 1978).

claim language "ion beam source" to "Kaufman-type ion beam source" by making an amendment this court has determined to be "related to patentability." This record suffices to exclude duoplasmatron sources from the permissible range of equivalents.

Determining whether Litton's conduct estops it from claiming that either Honeywell's hollow cathode or its RF ion beam source is an equivalent presents a more complicated inquiry. The examiner did not cite a hollow cathode ion beam source nor an RF ion beam source. Therefore, Litton did not amend its claim to avoid these sources. However, this alone does not preclude estoppel.

Presented with section 103 rejections to all its claims based upon the many references which Litton repeatedly cited and expressly distinguished, Litton demonstrated patentability over the prior art by submitting declarations attesting to the unexpected results obtained from the Kaufman-type source. *See* Paper Nos. 16 at 5 (Baumeister declaration) and 16A at 3 (declaration of Dr. Samuel Lu). Moreover, Litton argued in unmistakable terms that the phrase "ion beam source" referred only to a "Kaufman-type ion beam source." *See, e.g.*, Paper No. 15 at 8. The record shows Litton made that argument in the face of at least five other types of ion beam sources among the eighty-three references and the Harper chapter. These included a hollow cathode source discussed in the Harper chapter and an RF ion beam source described in the Lane article (Reference No. 73 among Litton's oft-cited references).

On the unique facts of this case—Litton's unmistakable arguments that its claims encompassed only the "Kaufman-type ion beam source," the five (or six) unambiguous declarations by Litton and its affiants

expressly distancing its invention from the references before the examiner, and Litton's amendment—one of ordinary skill in the art would reasonably conclude that Litton surrendered the other ion beam sources disclosed in the references before the examiner. Contrary to what the dissent suggests, these references were central to the course of the prosecution. Moreover, this result does not automatically, without more, mandate that in every case an estoppel arises based on any reference before an examiner. Rather, in this unique case, Litton repeatedly referred expressly to the many references it presented to the examiner, distinguished each reference by number over and over, and then further insisted that its claims encompassed only processes with Kaufman-type sources. To confirm that its invention was different from these references, Litton further amended its claim—in the face of its knowledge of all the ion beam sources disclosed in these references—in response to the examiner's rejection. Under these telling circumstances, the administrative record estops Litton from asserting the equivalence of any ion beam source before the examiner.

In view of Honeywell's accused devices, the hollow cathode source disclosed in the Harper chapter and the RF source disclosed in the Lane article are particularly relevant to the inquiry of estoppel here. The Harper chapter provided a detailed discussion of the Kaufman ion source and then suggested substituting a hollow cathode for "the [hot-wire] cathode in applications where lifetime or contamination from the cathode are important."

The Lane article described an ion beam source comprising an RF discharge maintained in an argon-filled glass cylinder. The RF discharge was maintained by

means of one external coil connected to a generator and regulated by means of a second coil, wound around the first and connected to a capacitor. Two focusing electrodes achieved the ion extraction. A plate at the end of the cylinder with a central hole 3/8 inch in radius served as one electrode; the second electrode was located within the cylinder and contained a second hole 1/4 inch in radius, aligned 1/4 inch from the plate. Conceivably, the two focusing holes are analogous to the Kaufman-type grids, which have numerous holes.

Other sources before the examiner may be relevant. However, the trial court made no findings about the relationship, if any, between any of the sources before the examiner and the sources in Honeywell's accused processes. For example, if the pertinent differences between either (1) the Harper source and Honeywell's hollow cathode source or (2) the Lane source and Honeywell's RF source are trivial, then the surrender of each disclosed source necessarily includes a surrender of its corresponding accused source. *See Southwall*, 54 F.3d at 1580. Alternatively, if the differences between either (1) the Harper source and Honeywell's hollow cathode sources or (2) the Lane source and Honeywell's RF sources are not trivial, then Litton did not surrender the accused source by surrendering the corresponding disclosed source.

Yet whether Honeywell's hollow cathode and RF ion beam sources constitute trivial variations of the Harper and Lane sources, respectively, are factual determinations that the district court never addressed. The same is true for any other sources before the examiner. Because the trial record is silent on these issues, this court cannot conclude as a matter of law whether the record estops Litton from asserting that the accused

hollow cathode and RF sources are equivalents of the Kaufman-type limitation. *See Hormone Research Found. v. Genentech, Inc.*, 904 F.2d 1558, 1564, 15 USPQ2d 1039, 1044 (Fed. Cir. 1990) ("[T]he scope of estoppel can depend on factual questions regarding the prosecution history, which may be disputed. . . .").

Accordingly, this court remands for a determination of the factual issues underlying prosecution history estoppel: namely, whether the accused hollow cathode source or the accused RF source constitutes a trivial variation of any of the sources before the examiner. If the district court determines that the variations are trivial for either of the accused sources, it should enter judgment as a matter of law that the process using that accused source does not infringe under the doctrine of equivalents. However, if the district court concludes that there is no estoppel, then it should proceed with the factual determination of infringement under the doctrine of equivalents.

Regardless of the triviality of the pertinent differences between Honeywell's RF source and any of the sources before the examiner, Honeywell nonetheless claims it should prevail on a different theory. Honeywell maintains that Litton should be estopped from asserting the equivalence of at least the accused RF ion beam source because, at the time of the Kaufman-type amendment, one of ordinary skill in the art knew that Honeywell's RF source could have been used as a substitute in Litton's patented process. Honeywell argues that that knowledge should be imputed to Litton, and therefore Litton's arguments and its amendment manifest a surrender of any potential equivalents covering Honeywell's RF process.

Honeywell points to a number of references in the trial court record—but not the administrative record before the PTO—establishing that RF ion beam sources similar to Honeywell's were in existence at the time of the Kaufman-type amendment. For example, the article, "Radio Frequency Ion Sources for Electrostatic Propulsion" by Horst W. Loeb, was distributed to one of Litton's named inventors at a 1971 symposium. The Loeb reference disclosed a method of ion extraction from an RF discharge plasma using aligned, perforated plates, which resemble grids under Honeywell's ex post reading. Another reference is entitled *Operation of Broad-Beam Sources*, by Harold R. Kaufman, the inventor of the Kaufman gun, and Raymond S. Robinson. The Kaufman book indicates that, by at least 1987, a few gridded RF ion beam sources had been used in industrial applications.

If one of ordinary skill in the art knew of the interchangeability of Honeywell's RF source when the Kaufman-type amendment was made, so Honeywell's argument goes, then a person of ordinary skill reasonably would conclude from the patent's prosecution history that this source, too, had been surrendered. *See Mark I Mktg.*, 66 F.3d at 291-92.

However, even assuming *arguendo* that one of ordinary skill in the art would have known of the interchangeability of Honeywell's RF source at the time of the Kaufman-type amendment, this argument must fail. To accept this argument would be essentially to accept the premise that when an applicant makes an amendment to an element to overcome the prior art, he has automatically surrendered all then-known substitutes to the amended element. Because known interchangeability is often synonymous with equiva-

lence, the result would generally be to allow only after-arising equivalents for amended elements. This is simply a variation of the no-equivalents theory already rejected by the Supreme Court and this court and must itself be rejected.

Reliance on this theory would not comport with the principles on which prosecution history estoppel is based. An applicant cannot surrender that which he does not know, but this theory would impute the knowledge of those of ordinary skill in the art to the applicant and deem it surrendered. Because the prosecution history is objective evidence of what knowledge the applicant has of the art, prosecution history estoppel should remain limited to the prosecution history.

State Law Claims

In addition to the findings of infringement of Litton's patent, the jury found Honeywell liable for two state law torts, intentional interference with contractual relations and intentional interference with prospective economic advantage. In making its liability determinations, the jury determined that Honeywell's activities were not privileged because Honeywell used "wrongful means." The jury's special verdict does not reveal what it considered to be "wrongful means." The district court granted Honeywell's motion for JMOL on the state law claims. Although an appellate court must sustain a jury verdict against a JMOL if there are *any* reasonable grounds for the verdict, *see Litton I*, 87 F.3d at 1573 n. 3, an appellate court must also vacate a jury verdict and remand for a new trial if a jury may have relied on an impermissible basis in reaching its verdict, *see Richards v. Michelin Tire Corp.*, 21 F.3d 1048, 1055 (11th Cir. 1994). Because the jury may have relied on

its finding of patent infringement as the "wrongful means," and because this court vacates and remands on the issue of patent infringement, it must do the same for the state law claims. Accordingly, this court reverses the trial court's grant of JMOL, vacates the jury's verdict, and remands for further proceedings in accordance with state law.

Conclusion

This court: (1) reverses the trial court's grant of JMOL and reinstates the jury's verdict that the asserted claims of the '849 reissue are not invalid for obviousness; (2) reverses the trial court's determination of inequitable conduct; (3) affirms the trial court's order finding intervening rights; (4) affirms the trial court's grant of JMOL that the accused hollow cathode and RF ion beam processes do not literally infringe the asserted claims of the '849 reissue; (5) vacates the trial court's grant of JMOL that the accused RF ion beam process does not infringe the asserted claims of the '849 reissue under the doctrine of equivalents, vacates the jury's verdict on that issue, and remands for further proceedings; (6) vacates the jury's verdict that the accused hollow cathode process infringes the asserted claims of the '849 reissue under the doctrine of equivalents and remands for further proceedings; (7) reverses the trial court's grant of JMOL with respect to the torts of intentional interference with contractual relations and intentional interference with prospective economic advantage, vacates the jury's verdict on that issue, and remands for further proceedings; and (8) affirms the trial court's grant of a new trial on damages, if necessary.

Costs

Each party shall bear its own costs.

AFFIRMED-IN-PART, REVERSED-IN-PART, VACATED-IN-PART and REMANDED.

PAULINE NEWMAN, Circuit Judge, concurring in part, dissenting in part.

I concur in the judgment insofar as it remands the case to the district court for redetermination of infringement in terms of the doctrine of equivalents. The jury's claim construction was the subject of sharply conflicting expert testimony at trial, and there was substantial evidence on which a reasonable jury could have reached its claim construction, which in turn supported its verdicts of infringement. However, applying *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 116 S. Ct. 1384, 134 L.Ed.2d 577, 38 USPQ2d 1461 (1996), and construing the claims *de novo*, I agree with the court that the "Kaufman-type" ion beam source was incorrectly construed. The correct construction of "Kaufman-type" precludes a finding of literal infringement by these two beam sources, and provides a fresh basis for determination of the question of equivalency. Since that was not the basis at trial, I concur in remanding for that purpose.

Since the correct construction of "Kaufman-type" relies heavily on the prosecution history, I agree that guidance to the trial court is warranted. However, I do not agree with the panel majority that a search report, filed in compliance with the duty of disclosure, produces prosecution history estoppel as to the complete and detailed content of all of the references listed in that report. References not cited by and not relied on by the examiner, but filed and explained by the applicant in

accordance with Rule 56 and its implementing rules, do not generate prosecution history estoppel. The role of the prosecution history in generating an estoppel is different from its role in construing the claims. Thus I must, respectfully, dissent from the panel majority's change in the law of prosecution history estoppel.

A. The Patentability Report

Litton filed a Patentability Report listing eighty- two references: forty-two scientific articles and forty United States and foreign patents. Litton also filed a document containing concise explanations of the relevance of each listed reference. The Report is a collection of the major scientific and technical literature on optical film production by ion beam sputtering, and includes not only references on the Kaufman-type ion beam source but also the duoplasmatron, hollow cathode, radio frequency, and most or all other sources of ion beams, as well as the technology of producing laser mirrors. The examiner cited the entire Report, without analysis of its contents, as "admitted prior art." Indeed, these eighty-two (later enlarged to eighty-three) references span the field of optical films formed by ion beams.

The report was filed in compliance with 37 C.F.R. § 1.56, in accordance with § 1.97(a):

> **§ 1.97(a)** (1985) As a means of complying with the duty of disclosure set forth in § 1.56, applicants are encouraged to file an information disclosure statement. . . .

For each of the eighty-two references Litton provided a statement of the subject matter and its relevance, as required by 37 C.F.R. § 1.98(a)(2):

> **§ 1.98(a)** (1985) Any disclosure statement filed . . . shall include . . .
>
> **(2)** a concise explanation of the relevance of each listed item.

Thus for each reference Litton provided a one-sentence summary, of which the following are typical:

> The Spenser et al article discloses ion beam-deposited polycrystalline diamond-like films, but does not disclose Applicants' claimed ion beam sputtering methods.
>
> The Prival et al article discloses ion beam sputtering apparatus and techniques, but does not disclose or suggest Applicants' claimed ion beam sputtering techniques.

Paper No. 3, pp. 13,15.

In examining the original patent the examiner had cited four patents and two articles. In examining the reissue application the examiner cited the Patentability Report as "admitted prior art" and two references: the Bernard patent and the Laznovsky article. The examiner explained that the admitted prior art showed these laser mirrors broadly, and cited Bernard and Laznovsky for specific aspects of the invention. The entire text of the examiner's rejection is as follows:

> Claims 1 and 3-15 are rejected under U.S.C. § 103 as being unpatentable over the combination of admitted prior art contained in "Patentability Report" filed by applicants on August 30, 1985 and Laznovsky.
>
> The prior art cited by applicants and mentioned in the "Background of the Invention" section of the original patent amply establishes that laser mirrors

comprising quarter wave stacks of layers of materials of different refractive indices materials were known prior to the instant invention. Laznovsky teaches, commencing at page 52 thereof, that ion beam sputtering using a rotating substrate may yield uniform films. Moreover, Laznovsky at page 54 teaches that ion beam sputtering of certain oxidic targets results in loss of oxygen, which must be compensated for by addition of oxygen background gas to the atmosphere inside the vacuum chamber. The features recited in instant claims 3 and 8 are also disclosed by Laznovsky.

[The Bernard patent] cited by applicants . . . is cited and . . . teaches that multiple layer coatings comprising different materials sputtered from different targets may be formed by ion-beam sputtering (Bernard, Col. 1, lines 38-51; col. 4, lines 1-18).

It thus would have been obvious, at the time the invention was made, to fabricate the known multi- layer laser mirror stacks using the apparatus and techniques of Laznovsky (including stoichiometry control of deposited films by oxygen addition to the background gas, substrate rotation, pre-sputter cleaning of the targets by ion bombardment, and target cooling), in view of the clear teachings of Bernard pertaining to the use of multi-targeted ion-beam sputtering apparatus for depositing multilayered films of differing composition. Choice of suitable layer materials of higher and lower refractive index clearly follows from the prior art and does not constitute unobvious modification of the references.

. . . .

Claims 14-15 are rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35

> U.S.C. § 103 as obvious over the admitted prior art. As for product-by-process claims 14 and 15, a 35 U.S.C. § 102/35 U.S.C. § 103 rejection is fair and proper in view of [citing cases]. . . .

Paper No. 6, pp. 5-6.

Of the references listed in the Patentability Report only the Bernard patent was cited by the examiner. None of the eighty-one other references was mentioned by the examiner, throughout the lengthy prosecution. The examiner referred to the "admitted prior art" as "establish[ing] that laser mirrors comprising quarter wave stacks . . . were known prior to the instant invention." *See supra.*

Litton responded by distinguishing its invention from the prior art mirrors and from the teachings in the Laznovsky and Bernard references, and from the "admitted prior art" as follows:

> The remaining references that fall within the category that the Examiner has denominated 'admitted prior art' are, in Applicants' opinion, of marginal relevance. Please see Applicants' Reissue Declaration and Power of Attorney accompanying this amendment for a discussion of the patentable distinctions between the claims on file and the disclosures of these references.

In the referenced Reissue Declaration Litton grouped all of the references listed in the Patentability Report, in general statements of which the following is typical:

> Claims 1 and 13 also patentably distinguish over items 1-15, 17-19, 21, 23 and 24, 26-41, and 44, 45, 48 and 49 above, because none of these references discloses an ion-beam sputtering method to make any product, let alone the multiple-layer optical

films comprising optical layers having different indices of refraction referred to in claims 1 and 13.

Paper No. 8, p. 17. It is incorrect to hold that by these statements Litton generated prosecution history estoppel as to the complete content of each and every one of the eighty-one uncited references. These broad and non- specific distinctions of groups of uncited references do not eliminate recourse to equivalency as to the entire subject matter of every uncited reference. The examiner is required, by the rules of patent examination, specifically to identify the references on which he is relying and to state the reasons for any rejection. Manual of Patent Exam. Proc. § 707.07(d). That was done as to Bernard and Laznovsky, the references that were "central to the course of the prosecution," in the words of the panel majority. It is simply incorrect to assign "centrality" and thus estoppel to the eighty-one references on the list, none of which the examiner or Litton identified as grounds of unpatentability.

Over the course of the prosecution Litton made several resubmissions of the Patentability Report and the explanation of relevance. All of the documents that the majority characterizes as Litton's "repeated references" to the eighty-three items are the filing or refiling of these same documents. Thus, after their initial filing, the Patentability Report and the explanation of relevance were again filed, attached to a declaration of Joel Nathanson, an officer of Litton, accompanied by discussion of the Bernard and Laznovsky references and the issues raised by a third-party protester to the reissue. In a subsequent declaration of Dr. Baumeister he also attached the Patentability Report, and specifically argued Bernard and Laznovsky

in the context of the state of this art as shown in the Report.

These documents were again filed when the examiner required a new Reissue Oath, wherein Litton again broadly and briefly distinguished the listed references by categories. An example is the following:

> Claims 1 and 13 also patentably distinguish over references 54, 64, and 73 because they disclose ion-beam sputtering techniques for depositing multiple-layer films, but not multiple-layer optical films, let alone by an ion-beam sputtering technique that includes the atmosphere-controlling step of claims 1 and 13.

Paper No. 8, p. 8.

Finally, the same documents were sent to the PTO when a complete copy of the Nathanson declaration was submitted in response to the PTO's investigation of the protester's accusation of inequitable conduct.[1] These are the six "over and over" submissions stressed by the panel majority. It is incorrect to describe these resubmissions of the same documents as "repeated

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[1] The Rules require public notice of every application for reissue, and provide for the filing of protests by interested persons. 37 C.F.R. § 1.292. The protester charged Litton with inequitable conduct on the ground that Litton had included too many references in the Patentability Report, and should have listed only those few that Litton believed were closest to its invention. The PTO investigated the charge, as it is required to do, and exonerated Litton of any wrongdoing. Indeed, while the panel majority holds that Litton by its presentation of this Report and statements of relevance had established prosecution history estoppel as to each listed item, the protester argued that the list and accompanying statements were insufficient to bring any of the listed items before the examiner.

references" that transform into prosecution history estoppel the entire content of every reference on the Patentability Report. Further, Litton did not "acknowledge" that each reference on the Report was of prior art status, as the panel majority states. Litton simply repeated the examiner's words, in the conventional form of an applicant's Response:

> Remaining for consideration is the Examiner's rejection of claims 1, 3-10, 12 and 13 under 35 USC § 103 as allegedly unpatentable over the combination of what the Examiner calls the "admitted prior art" contained in the patentability report in view of Laznovsky or over French Patent 2,129,996 [the Bernard patent] in view of Laznovsky.

Paper No. 10, pages 4-5. This was not an admission that the eighty-one references in addition to Bernard and Laznovsky were grounds of estoppel.

The use of an applicant's search report to create an estoppel as to references not specifically cited by the examiner and not a basis of rejection, is a major change in the law of prosecution history estoppel. Applicants often submit lengthy lists of references in compliance with Rule 56, lest they be charged with inequitable conduct for whatever they leave out. The filing of a list of references in accordance with Rule 97, and their description under Rule 98(a)(2), does not create an estoppel as to the full technical content of every reference on the list. Estoppel arises from an examiner's rejection based on a specific reference and an applicant's position taken to avoid that specific reference. *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, ——, 117 S. Ct. 1040, 1049, 137 L.Ed.2d 146, 41 USPQ2d 1865, 1871-72 (1997); *Mannesmann Demag Corp. v. Engineered Metal Products Co.*,

793 F.2d 1279, 1285, 230 USPQ 45, 48 (Fed. Cir. 1986). It does not arise from the applicant's exposition of his invention and its place in the field of technology. Such an exposition may be relevant to claim interpretation; it does not, however, produce prosecution history estoppel as to uncited references.

The mischievous consequence of this new rule is to convert into estoppel the information provided in accordance with the duty of disclosure. The history of Rule 56 shows the many uncertainties and pitfalls surrounding an applicant's provision of information to the Patent Office. The court today adopts a draconian rule of estoppel flowing from an applicant's compliance with the disclosure rules, for it is notorious that the applicant will be criticized wherever he draws the line in disclosing references known to him. This new rule can only deter the broad disclosure that has shielded applicants from the "plague" of inequitable conduct charges that the disclosure requirements have spawned. *Cf.* Notice of Final Rulemaking [Duty of Disclosure], 57 Fed. Reg. 2021, 2022 (1992) ("It is in the best interest of the Office and the public to permit and encourage individuals to cite information to the Office without fear of making an admission against interest.") This new pitfall in an already uncertain practice diminishes the utility of the patent system, thereby disserving the national interest in innovation, new products, and industrial growth.

B. The Remand Instructions

The panel majority instructs the district court to determine, in implementation of this new basis of prosecution history estoppel, whether the accused Honeywell processes involve a "trivial variation of any of the sources before the examiner," and particularly

whether there is such variation from the teachings of two references selected from the list of eighty-three. The two references are No. 73 in the Patentability Report and a textbook chapter by Harper that was referred to in the Baumeister declaration. The references are selected by the panel majority, with Honeywell's help. Neither reference was a ground of rejection by the examiner.

Reference No. 73 is a scientific article by G.E. Lane and J.C. Anderson entitled "The Nucleation and Initial Growth of Gold Films Deposited onto Sodium Chloride by Ion-Beam Sputtering," published in *Thin Solid Films* in 1975. The panel majority instructs the district court to ascertain whether the differences are "trivial" between the Lane radio frequency ion beam source and the radio frequency ion beam source used by Honeywell. The majority's position is that if the differences are in fact trivial, then Litton is estopped from asserting equivalency between the Honeywell radio frequency beam and the Litton Kaufman-type beam. (Honeywell does not state that it is practicing the prior art as contained in these references.)

In its statement under Rule 98(a)(2) Litton had described the Lane article as follows:

> The Lane et al article discloses the nucleation and initial growth of gold films deposited onto sodium chloride by ion beam sputtering, but does not disclose Applicants' claimed methods.

Paper No. 3, p. 14. Reference No. 73 is also mentioned in the following sentence, which I quoted *supra* from the document filed with the Supplemental Reissue Declaration:

> Claims 1 and 13 also patentably distinguish over references 54, 64, and 73 because they disclose ion-beam sputtering techniques for depositing multiple-layer films, but not multiple-layer optical films, let alone by an ion-beam sputtering technique that includes the atmosphere- controlling step of claims 1 and 13.

Paper No. 8, p. 8. The examiner never cited or referred to the Lane article. Such general statements by the applicant do not, should not, produce an estoppel as to the entire technical subject matter content of the reference.

The majority similarly instructs the district court concerning a chapter by James M.E. Harper entitled "Ion Beam Deposition" in *Thin Film Processes* (1978), with respect to the hollow cathode tube as a source of ion beams. This chapter was not among the eighty-three listed references, but was referred to by Dr. Baumeister as a "comprehensive review article" that "neither teaches nor suggests the use of any ion-beam sputtering technique to make any multi- layer optical film." Paper No. 16, p. 4. That was the extent of the contribution of Harper to the prosecution. The examiner did not mention Harper, either before or after Baumeister's submission.

The district court had already reviewed and rejected Honeywell's arguments about prosecution history estoppel. The district court correctly stated that "the file history does not indicate that these other sources were ever the subject of discussion with the examiner—only duoplasmatron ion beam sources [Bernard] and the ion beam source in the specification [Laznovsky] were specifically mentioned by the examiner in making his determination." Slip op. at 89, 1995

WL 366468, at *45. The district court correctly stated that prosecution history estoppel could be based only on sources "discuss[ed] with the examiner." This ruling is in accordance with the Court's holding in *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146, 41 USPQ2d 1865 (1997), that prosecution history estoppel is based on responses to the examiner's rejections "in which 'the applicant, in order to meet objections in the Patent Office, *based on references to the prior art*, adopted the phrase as a substitute for the broader one' previously used." 520 U.S. at —— - ——, 117 S. Ct. at 1049-50, 137 L.Ed.2d 146, 41 USPQ2d at 1872 (emphasis the Court's). The new rule of the panel majority is a marked departure from this precedent, a departure that is not only contrary to the Court's holding in *Warner-Jenkinson*, but serves no useful purpose.

This new rule seriously erodes the doctrine of equivalents, with the anomalous result that the more fully the patent applicant complies with the duty of disclosure, the greater the range of equivalents he stands to lose to prosecution history estoppel. The inappropriate consequences of this ruling are revealed in today's result whereby the trial court must base prosecution history estoppel on two references that neither the applicant, the examiner, the protestor, nor the trial judge, considered relevant. From this rule, and its application in this case, I must dissent.

APPENDIX I

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 95-1242, 95-1311

LITTON SYSTEMS, INC., PLAINTIFF-APPELLANT

v.

HONEYWELL, INC., DEFENDANT-CROSS APPELLANT

June 18, 1998

ORDER

A combined petition for rehearing and suggestion for rehearing in banc having been filed by the Appellant, and a response therto having been invited by the court and filed by the Cross Appellant, and the petition for rehearing having been referred to the panel that heard the appeal and thereafter the suggestion for rehearing in banc and response having been referred to the circuit judges who are in regular active service, and a poll whether to rehear the appeal in banc having been requested, taken, and failed, it is

ORDERED that the petition for rehearing be, and the same hereby is, DENIED; and it is further

ORDERED that the suggestion for rehearing in banc be, and the same hereby is, DECLINED.

Circuit Judges Plager, Clevenger, and Gajarsa dissent in separate opinions.

Circuit Judge Newman has filed a separate opinion with views on the suggestion for rehearing in banc.

The mandate of the court will issue on June 25, 1998.

PLAGER, Circuit Judge, dissenting from the Order declining the suggestion for rehearing in banc.

There is perhaps no question more important to the health of patents than the scope and application of the judicially-created doctrine of equivalents. It permeates the entire fabric of patent law, and appears in virtually every case involving patent enforcement. A candid appraisal of our jurisprudence in this area suggests that there is room for improvement. The Supreme Court's latest contribution, *Warner-Jenkinson Co. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146 (1997), helps, but still leaves some questions unanswered.

It is not clear to me exactly what the Supreme Court had in mind when it said that, as a result of an amendment related to patentability, "prosecution history estoppel would bar the application of the doctrine [of] equivalents as to that element." *Id.* at 1051. Perhaps the Court had no intention of changing our existing practice; that is the position of the panel opinion in this case, which, as I understand it, essentially attributes no special significance to the Supreme Court's statement, and to its general explication of the doctrine of equivalents. The panel applies this court's pre-existing mode of analysis to determine when and to what extent prosecution history estoppel operates.

Or perhaps the Court intends for us to rein in the doctrine still further and strictly limit the range of

equivalents available, as suggested by Judge Gajarsa in his dissent from our failure to accept this case for rehearing in banc. He views that failure as a "missed occasion to square our view of the doctrine of equivalents with the view . . . [of] the Supreme Court." Judge Clevenger also dissents, and believes that the Supreme Court needs to tell us exactly what it meant, or that it meant what it seems to have said.

In any event, the Supreme Court in its *Warner-Jenkinson* opinion charged the Federal Circuit with the responsibility to "refine the formulation of the test for equivalence in the orderly course of case-by-case determinations," and left that refinement to this court's "sound judgment in this area of its special expertise." *Id.* at 1054. As a court, we have the responsibility to carefully choose and develop the cases that will define the doctrine of equivalents in the years ahead. It may be that the case before us—it is rather convoluted and the technology is obscure to the uninitiated—is not the best one in which to address the issue of prosecution history estoppel. This court's decision not to rehear the case in banc does not mean that the issue will go away. Indeed, whether our failure to do so will prove to be a missed opportunity, or simply an example of a fruit not yet ripe to pluck, remains to be seen.

CLEVENGER, Circuit Judge, dissenting from the Order declining the suggestion for rehearing in banc.

As Judge Gajarsa demonstrates in his opinion, explicit language in the Supreme Court's *Warner-Jenkinson* opinion states that when a limitation in a claim is amended for patentability reasons (or is presumed to be amended for that reason in the absence of another explanation) the doctrine of equivalents is not available for assertion with respect to the amended

limitation. Indeed, the Supreme Court's words "bar the application of the doctrine of equivalents" to the amended limitation.

The long-standing law of prosecution history estoppel holds that when a limitation in a claim is amended for patentability reasons, the doctrine of equivalents is available for assertion with respect to the amended limitation, but that the patentee may not assert as an equivalent to the amended limitation any matter surrendered in order to overcome the threat to patentability presented by the originally claimed limitation. Thus, under the pre-*Warner-Jenkinson* law of prosecution history estoppel, a patentee potentially could assert a range of equivalents to a claim amended for reasons of patentability.

In this case, the panel decision holds that the Supreme Court in *Warner-Jenkinson* did not mean to alter the range of equivalents available to a patentee under the doctrine of equivalents, notwithstanding the explicit language in the Supreme Court's opinion stating that *no equivalents* are available to a claim limitation amended for reasons of patentability.

Whether to read the Supreme Court's opinion at face value, or whether to discount its explicit language as unintended, unclear, uninformed, unfathomable, or whatever, seems to me a matter of considerable importance, so much so that the matter satisfies the test for issues that should be decided by an in banc court.

Although we let a panel decide whether the Supreme Court sought to narrow the reach of the doctrine of equivalents, or whether it instead sought to leave the doctrine "as is" (the latter being the panel decision in this case), hopefully the Supreme Court will have an

occasion to decide whether our panel got it right. Someone, in this case or in another case soon, should explain to the Supreme Court that—if this panel is correct in granting a range of equivalents to limitations of claims amended for patentability reasons—its *Warner-Jenkinson* decision had no meaningful effect at all on the doctrine of equivalents. This is so because the so-called "all elements" rule described by the Supreme Court has been around for a long time, deeply embedded in Federal Circuit jurisprudence, and the presumption that claims are amended for patentability reasons unless proven to the contrary adds not much to the law, since claims are rarely amended for reasons other than patentability. The new, and significant, narrowing of the doctrine of equivalents that shows on the face of the Supreme Court's opinion is the point that the panel decision in this case rejects: that limitations in claims amended for patentability reasons lose, entirely, the benefits of the doctrine of equivalents.

GAJARSA, Circuit Judge, dissenting from the Order declining the suggestion for rehearing in banc.

INTRODUCTION

Because the doctrine of equivalents "has taken on a life of its own, unbounded by the patent claims," the Supreme Court severely curtailed the reach of the doctrine in its recent decision in *Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146 (1997). The curtailment is precise and explicitly defined in the Court's opinion, as I will demonstrate below, and we are obligated to give effect to the restrictions the Supreme Court has placed on the doctrine. The panel opinion in this case, how-

ever, did not heed these instructions and has left the doctrine of equivalents virtually intact, notwithstanding the unmistakable intent of the Court to narrow the reach of the doctrine of equivalents. I am thus compelled to dissent from this missed occasion to square our view of the doctrine of equivalents with the view so recently stated with such force, clarity and precision by the Supreme Court. This court must follow, not ignore, the new framework set forth by the Supreme Court as it limited the doctrine of equivalents.

Patents provide inventors with a legal right, for a limited time, to exclude others from using, selling, offering to sell, or manufacturing the invention. In essence, patents give their owners significant power over the development of technology and markets by giving patentees the right to exclude others from using their inventions. For this privilege, the government extracts a public disclosure of the invention in the hope that, among other things, the disclosure of all inventions will add to the sum total of knowledge available to the general public. Competitors and the markets, as well as the courts, must be able to ascertain what subject matter is covered by this right to exclude. Public notice of the scope of the right to exclude, as provided by the patent claims, specification and prosecution history, is a critical function of the entire scheme of patent law. The notice function is critical because it provides competitors with the necessary information upon which they can rely to shape their behavior in the marketplace.

The Supreme Court has recently stated that "[t]here can be no denying that the doctrine of equivalents, when applied broadly, conflicts with the definitional and public-notice functions of the statutory claiming re-

quirement." *Id.* at 1049. In *Warner-Jenkinson*, the Supreme Court has also provided useful guidelines that can be used by the public to better decipher the real meaning and scope of patents. Now that the Supreme Court has "clarif[ied] the proper scope of the doctrine," we fail in our responsibility if we do not follow the Supreme Court's precise instruction to restrain the doctrine of equivalents. *Id.* at 1045.

THE SUPREME COURT'S DECISION IN *WARNER-JENKINSON*

In *Warner-Jenkinson*, the Supreme Court announced a new framework expanding the preclusive effect of prosecution history estoppel. The context of the *Warner-Jenkinson* opinion must be considered as we interpret the Supreme Court's mandate. The Supreme Court specifically disagreed with the petitioner's argument that, regardless of the reason the amendment was made, prosecution history estoppel barred all equivalents to an amended claim element. *See Warner-Jenkinson*, 117 S. Ct. at 1049-50. Instead, the Supreme Court differentiated between amendments that were made for patentability reasons, and those that were not. *See id.* The Supreme Court was clear that "[w]here the reason for the change was not related to avoiding the prior art, the change may introduce a new element, but it does not necessarily preclude infringement by equivalents of that element." *Id.* at 1050-51. Thus, the Supreme Court did not change the availability of the doctrine of equivalents where amendments were made for reasons clearly *not* related to patentability. Rather, the Supreme Court focused its attention on additional limitations to the doctrine of equivalents where amendments were made for unknown reasons as well as reasons related to patentability.

In addressing the fact situation presented in *Warner-Jenkinson*, in which "a pH from approximately 6.0 to 9.0" was added to the claim, 117 S. Ct. at 1050, the Supreme Court noted that it was undisputed that the upper limit of 9.0 was added for patentability reasons, while the reason for adding the lower limit of 6.0 was unclear. The Supreme Court stated that, because it was unclear whether the limit of 6.0 was added for patentability reasons, its mere inclusion "did not *necessarily preclude* the application of the doctrine of equivalents as to that element." *Id.* (emphasis added). This statement implies that, while the lower limit of 6.0 was not necessarily precluded from being infringed by equivalents, the upper limit of 9.0 could not be infringed by equivalents.

The Supreme Court next stated that it was "left with the problem, however, of what to do in a case like the one at bar, where the record seems not to reveal the reason for [amending the claim]." *Warner-Jenkinson*, 117 S.Ct. at 1051. The Supreme Court then resolved this issue by placing "the burden on the patent-holder to establish the reason for the amendment required during patent prosecution. The court then would decide whether that reason is sufficient to overcome prosecution history estoppel *as a bar to application of the doctrine of equivalents to the element added by that amendment.*" *Id.* (emphasis added). The language is clear. If the reason is insufficient to establish that the amendment was made for a reason not related to patentability, application of the doctrine of equivalents as to the amended element is *barred* by prosecution history estoppel. In these circumstances, there is *no* application of the doctrine of equivalents to the element amended.

The Supreme Court further explained that where no reason was established for the amendment, prosecution history estoppel is applied as if there were a patentability reason for the change, thereby barring all application of the doctrine of equivalents as to that element. "Where no explanation is established, however, the court should presume that the PTO had a substantial reason related to patentability for including the limiting element added by amendment. *In those circumstances, prosecution history estoppel would bar the application of the doctrine [of] equivalents as to that element.*" *Id.* (emphasis added). This statement of the law is clear and is not open to multiple interpretations. The first sentence of the above quotation explains that when an amendment is made for an unknown reason, the amendment is to be treated as if it were made for a reason related to patentability. The Supreme Court has therefore unequivocally equated amendments made for unknown reasons with amendments made for patentability reasons. For all intents and purposes, they are the same. In the next sentence, the Supreme Court states that prosecution history estoppel *bars* application of doctrine of equivalents to those very same amendments which it has just said are to be treated as amendments related to patentability. Thus, the logic proceeds as follows: amendments made for unknown reasons are to be presumed to be amendments made for reasons related to patentability; prosecution history estoppel *bars* the application of the doctrine of equivalents to amendments made for unknown reasons; therefore, prosecution history estoppel also bars application of the doctrine of equivalents in cases where the amendment was made for reasons related to patentability.

The Supreme Court has explicitly linked those amendments made for unknown reasons to those made for patentability reasons. *See Warner-Jenkinson*, 117 S. Ct. at 1051. There can only be one purpose to this link—these two situations are to be treated similarly. If the Supreme Court had intended merely to bar the application of the doctrine of equivalents to amendments made for unknown reasons, this explicit link would have absolutely no purpose in the context of the opinion. Had the Supreme Court intended to bar the application of the doctrine of equivalents only to those amendments made for unknown reasons, it would have merely stated that "where no explanation is established, prosecution history estoppel would bar the application of the doctrine of equivalents as to that element." The link would be superfluous. It defies logic to read *Warner-Jenkinson* to hold that an amendment that is known to have been made for patentability reasons is to be treated differently than an amendment that is *presumed* to have been made for patentability reasons.

I therefore believe the plain meaning of the Supreme Court's decision in *Warner-Jenkinson* to be: if a claim is amended during prosecution, the patentee has the burden of showing why the change was made. If the change was made for reasons of patentability or if the reasons are unknown, then prosecution history estoppel completely bars the application of the doctrine of equivalents as to that amended element. If, however, the patentee can show the element was amended for a reason not related to patentability, then prosecution history estoppel does not bar the application of the doctrine of equivalents as to that amended element.

THE LITTON OPINION

The *Litton* panel implies that the Supreme Court did not mean what it said. *Litton* holds that the Supreme Court did not bar the application of the doctrine of equivalents to claim elements amended for patentability reasons. The majority interprets the *Warner-Jenkinson* opinion as holding that estoppel only bars recapture of that subject matter actually surrendered during prosecution and therefore amendments to overcome prior art do not result in a complete surrender of all subject matter beyond the literal scope of the amended claim. The *Litton* panel ultimately states that the Supreme Court only "articulated an additional rule to trigger, in applicable circumstances, prosecution history estoppel. But that is all the Supreme Court articulated . . . the Court did not change the scope or effect of the estoppel." *Litton Sys., Inc. v. Honeywell, Inc.*, 140 F.3d 1449, 46 U.S.P.Q.2d 1321, 1326 (Fed. Cir. 1998). In light of the explicit language used by the Supreme Court, this simply cannot be true.

The majority seeks to evade the clear holding of the Supreme Court through a tortured interpretation of the *Warner-Jenkinson* opinion.[1] The *Litton* panel argues

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[1] For example, the panel opinion states that "the entire context of the *Warner-Jenkinson* opinion shows that the Supreme Court approved [of] the PTO's practice of requesting amendments with the understanding that the doctrine of equivalents would still apply to the amended language." *Litton*, 140 F.3d 1449, 46 U.S.P.Q.2d at 1326. There is no evidence that such a practice exists. In deciding whether to allow a patent application to issue, an examiner does not consider the doctrine of equivalents. The United States Patent and Trademark Office (PTO) requires its examiners to determine only whether a patent application meets the statutory requirements of Title 35 of the United States Code

that the quotations from the Supreme Court cited above read in context do not completely preclude application of prosecution history estoppel to the doctrine of equivalents with regard to an amendment made for reasons related to patentability. In a convoluted attempt to avoid the literal language of the Supreme Court's holding, the *Litton* panel cites to footnotes 6 and 7 in *Warner-Jenkinson* to show that the Supreme Court did not mean what it said in the text of its opinion. *Id.* To begin with, it seems to be a peculiar method of legal analysis to use the footnotes to overcome the clear language of the text of an opinion. In addition, even if we assume these footnotes do contradict the text—how do we know whether the Supreme Court really meant what it said in the text or in the

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as well as various internal regulations. As a judicially-created doctrine, the doctrine of equivalents is not found anywhere in either Title 35 of the United States Code or in the Code of Federal Regulations governing PTO practice. As such, an examiner is in no way required or directed to consider the application of the doctrine of equivalents in determining whether to allow a particular patent application. Although the Manual of Patent Examining Procedure section 904.01(b) states that all subject matter that is the patentable equivalent of the subject matter defined in the claim is to be considered by the examiner, this section references sections 2181-84, which specifically refer to equivalents in the context of means-plus-function claims. Section 2186 similarly refers to the need for examiners to consider decisions involving the doctrine of equivalents, but only as they relate to determining equivalents in the context of examining claims written in means-plus-function form under 35 U.S.C. § 112, ¶ 6. There is no official directive from the PTO, nor any common practice among patent examiners, of considering during prosecution equivalents of claim limitations which are not written in means-plus-function form. The doctrine of equivalents is therefore not "assumed" by patent examiners in allowing claims as is suggested in the *Litton* opinion.

footnotes? Isn't the more appropriate analysis to give weight to the clear textual provisions?

Moreover, these footnotes do not even contradict the clear meaning of the text. The footnotes do not relate to the relevant textual provisions of the opinion, but rather modify other parts of the opinion. The *Litton* panel argues that in footnote 6, the Supreme Court refuses to "change the rules of the game." *Id.* However, while the *Litton* panel's citation is correct, the conclusion it draws from the footnote is faulty. In footnote 6, the Supreme Court refuses to change the rules of the game only with respect to the petitioner's proposed any-type-of-amendment, no-equivalents rule. *See Warner-Jenkinson*, 117 S. Ct. at 1050. This does not in any way modify the clear reasoning in an entirely different section of the text, which discusses amendments made for reasons related to patentability.

Similarly, as the *Litton* panel recognizes, footnote 7 does not address the issue of when the doctrine can be applied in light of an amendment related to patentability. *Litton*, 140 F.3d 1449, 46 U.S.P.Q.2d at 1326. Footnote 7 explains only how the estoppel is to be applied when an amendment is *not* related to patentability. Again, no conclusion as to the application of prosecution history estoppel to amendments made for reasons related to patentability can be drawn from this footnote. *See Warner-Jenkinson*, 117 S. Ct. at 1050.

The *Litton* panel further states that the caselaw from the Supreme Court and Federal Circuit regarding the scope of prosecution history estoppel contradicts Honeywell's reading of "a single isolated sentence" in the *Warner-Jenkinson* opinion. *Litton*, 140 F.3d 1449, 46 U.S.P.Q.2d at 1326. The Supreme Court is not required to reiterate its statements several times for

them to carry weight with the lower courts. Moreover, this was not a single isolated sentence, or random "fluke" of a statement. The Supreme Court devoted an entire paragraph to its reasoning barring the application of the doctrine of equivalents to claim language amended for reasons related to patentability. In addition, the Supreme Court repeats this statement twice: "The court then would decide whether that reason is sufficient to overcome prosecution history estoppel as a bar to application of the doctrine of equivalents to the element added by that amendment. . . . In those circumstances [the amendment is presumed to have been made for reasons related to patentability], prosecution history estoppel would bar the application of the doctrine [of] equivalents as to that element." *Warner-Jenkinson*, 117 S. Ct. at 1051. Moreover, the Supreme Court specifically referred to this portion of its opinion when it said "[s]o long as the doctrine of equivalents does not encroach beyond . . . limits to be discussed infra. at 1051-1052, 1053, n. 8, and 1054-1055, we are confident that the doctrine will not vitiate the central functions of the patent claims themselves." *Id.* at 1049 (emphasis added). Pages 1051 and 1052 are the very pages that contain the language barring the application of doctrine of equivalents to claim language amended for reasons related to patentability. Thus, it is evident that this explicit limitation in the Supreme Court's opinion was not some kind of inadvertent error, but rather an essential part of the Supreme Court's plan to limit the doctrine of equivalents. We need to be clear in interpreting the Supreme Court's language and we must be consistent in our approach.

The *Litton* panel also cites to two Supreme Court cases to support its reading of *Warner-Jenkinson*. The

Litton panel cites *Keystone Driller Co. v. Northwest Engineering Corp.*, 294 U.S. 42, 55 S.Ct. 262, 79 L.Ed. 747 (1935) and *Smith v. Magic City Kennel Club, Inc.*, 282 U.S. 784, 51 S. Ct. 291, 75 L.Ed. 707 (1931) for the proposition that the Supreme Court has acknowledged the concept that an estoppel has an appropriate scope. The best that can be said of these cases is they hold that, where an amendment has been made for patentability reasons, the patentee is estopped from recapturing through the doctrine of equivalents the originally claimed element. *See Keystone Driller*, 294 U.S. at 48, 55 S. Ct. 262; *Smith*, 51 S. Ct. at 293-94. These cases did not present to the Supreme Court the situation in which a patentee attempts to recapture matter that was not expressly disclaimed by amendment. Consequently these cases cannot be cited to support the proposition that the Supreme Court has already recognized that an estoppel is anything less than a complete bar to application of the doctrine of equivalents.

In *Exhibit Supply Co. v. Ace Patents Corp.*, 315 U.S. 126, 62 S. Ct. 513, 86 L.Ed. 736 (1942), the Supreme Court was presented with a situation in which the claim at issue was amended from a broader scope to a narrower one. *Id.* at 132-33, 62 S. Ct. 513. The patentee asserted the doctrine of equivalents to cover devices that fell somewhere within the scope of the broader claim, but not within the narrower, amended claim. The Supreme Court stated that "[b]y the amendment he recognized and emphasized the difference between the two phrases and proclaimed his abandonment of all that is embraced in that difference." *Id.* at 136, 62 S. Ct. 513. Thus, the Supreme Court was clear that the surrender was complete and covers all structures between the

precise matter surrendered and the structure literally claimed after amendment. In other words, all asserted equivalents as to the amended element had been abandoned during prosecution.

The *Litton* panel finally argues that the Supreme Court did not reach the scope of an estoppel in cases where the patent claims have been amended for reasons of patentability because the Supreme Court remanded for fact finding on application of the presumption. *See Litton*, 140 F.3d 1449, 46 U.S.P.Q.2d at 1327. While correct, this does not support the panel's conclusion that *Warner-Jenkinson* did not change the scope of subject matter precluded by an estoppel. Rather, the Supreme Court remanded for determination of the reason for the addition of the lower pH limit. This was done in order to determine whether the newly articulated *Warner-Jenkinson* presumption has been sufficiently rebutted to justify a finding that the amendment was not made for reasons of patentability and thus is entitled to some range of equivalents despite the amendment. Thus, the Supreme Court's decision to remand does not affect its decision regarding the preclusive effect of an amendment made for reasons related to patentability.

We require practitioners who appear before this court to apply rigorous logic and consistency in their advocacy; we should require no less of ourselves whenever we are providing directions to the bar. We should not allow ourselves the belief that we can interpret a Supreme Court opinion and, by metaphysical

metamorphosis, transform its position to one which we prefer.[2]

For the above-stated reasons, I believe the *Litton* panel misreads the clear instructions of *Warner-Jenkinson*. Given the serious ramifications of the *Litton* panel's views on the application and scope of the doctrine of equivalents in light of the clear instruction from the Supreme Court to the contrary, I believe that this case warranted in banc review.

PAULINE NEWMAN, Circuit Judge, views on the suggestion for rehearing in banc.

I write separately to point out that the decision of the court not to re-decide this case in banc does not bode the ominous portents suggested by my colleagues in dissent. Whether the panel has correctly implemented the modified rules of equivalency, as applied to the facts of this case, is of course of concern to all of us. Undoubtedly there will be continuing occasion to refine this complex area of law, in fulfillment of the process with which the Supreme Court has charged the Federal Circuit. However, although it is now apparent that there is more than one view of what was decided in *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 117 S. Ct. 1040, 137 L.Ed.2d 146, 41 USPQ2d 1865 (1997), I can not find in this court's remand opinion the accused "discount [of the Supreme Court's] explicit language as unintended, unclear, uninformed, unfathomable, or whatever."

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[2] It is interesting to note that Judge Newman's views expressed in this denial of the in banc hearing, continue the metamorphosis where a *threatened* 35 U.S.C. 112 rejection in the *Litton* patent prosecution history becomes *in fact* a 35 U.S.C. 112 amendment in the *Litton* opinion.

The panel conscientiously implemented the Court's new inquiry into whether an amendment was made for purposes of patentability, and found that an amendment made by *Litton* under 35 U.S.C. § 112 was indeed made for purposes of patentability. The panel pointed out that equivalency is to be evaluated at the time of infringement—another important clarification by the Court, applicable to the facts of record in *Litton*—as is the Court's resolution of whether the equitable issue of intent should be considered. The Court's continued acceptance of equivalency as a question of fact for the jury is also pertinent to the remand. Although the panel had no need to consider the "all-elements rule" as applied to the claims at issue, the Court's endorsement of that rule is also of significant effect.

Thus I am perplexed by the view of a colleague in dissent that the Court's opinion in *Warner-Jenkinson* would have "no meaningful effect on the doctrine of equivalents" unless the opinion is read as does the dissenter. In *Warner-Jenkinson* the Court expressed particular concern for the notice function of patent claims, as a guide to the Federal Circuit as we continue to develop rules for the newly circumscribed doctrine of equivalents. But the Court did not hold that whenever a claim is amended for reasons of patentability, recourse to equivalency is barred absolutely. The Court did not overrule—and was not asked to overrule—our voluminous precedent wherein the scope of prosecution history estoppel is determined as the facts warrant. *E.g., LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 867 F.2d 1572, 1576, 9 U.S.P.Q.2d 1995, 1999 (Fed. Cir. 1989) ("The effect may or may not be fatal to application of a range of equivalents broad enough to encompass a particular accused product. It is not fatal

to application of the doctrine itself.") Although the Federal Circuit has not been generous in its view of equivalency, it, like the Supreme Court, has recognized that the doctrine is an integral part of an effective patent system. The Court in *Warner-Jenkinson* did not change that view, and did not act to effect the drastic limitation of the doctrine of equivalents that is postulated by dissenters.

Every patent practitioner knows how rare it is to conclude patent examination with claims that have not undergone amendment during prosecution, based on the examiner's rejections on grounds of patentability. It is routine for claims to be rewritten several times during the give-and-take of the examination procedure. The practitioner knows, of course, about prosecution history estoppel. However, the practitioner understands that estoppel will be based on what was actually yielded, not that equivalency will be totally barred whenever any claim limitation is amended.

The interpretation of my respected colleagues in dissent can not be reconciled with the Court's statements, upon considering the views of the United States and other amici, that the doctrine of equivalents serves a useful purpose. It is unlikely that the Court, while stressing that it is preserving the doctrine of equivalents in the interest of justice, made an arcane ruling that would eliminate access to the doctrine of equivalents in almost every case. Whether to bar all equivalency to any claim limitation amended for reasons of patentability was not at issue in *Warner-Jenkinson*. Such a far-reaching ruling as the dissenters postulate can not have been reached by indirection, yet missed by the many commentators on the *Warner-Jenkinson* opinion. The historic custom and culture of patent

soliciting, wherein applicants present claims of varying scope and then work out the coverage in interaction with the examiner, would be affected, along with the scope of countless patents prosecuted and issued under those customs. This can not be the "face value" of the Court's holding. *See Warner-Jenkinson*, 520 U.S. 17, 117 S. Ct. at 1050 n. 6, 41 U.S.P.Q.2d at 1872 n. 6 ("To change so substantially the rules of the game now could very well subvert the various balances the PTO sought to strike when issuing the numerous patents which have not yet expired and which would be affected by our decision"); *id.* at n. 7 ("We do not suggest that, where a change is made to overcome an objection based on the prior art, a court is free to review the correctness of that objection. . . . What *is* permissible for a court to explore is the reason (right or wrong) for the objection and the manner in which the amendment addressed and avoided the objection.")

The petitioner in *Warner-Jenkinson* was directly concerned with the issue of whether the Hilton-Davis patent's claims were amended for reasons other than patentability, for infringement turned on the question of equivalency of the pH limit of 6.0. Although my colleague in dissent states that the Court's new presumption (about whether an amendment was made for purposes of patentability) "adds not much to the law," it was of critical importance to these litigants. It is unwarranted to trivialize the Court's reasoning on the dispositive issue in *Warner-Jenkinson*, in order to promote the argument that the Court intended to massively enlarge the restrictions on equivalency by placing an automatic and complete estoppel on every claim aspect for which the applicant argued patentability.

Such a change in the law of the Court and this circuit requires exploration, not indirection.

Undoubtedly the rules of equivalency will receive continuing and careful refinement, as experience accumulates of the practical needs and policy concerns that are served by this doctrine. This court's action in the case at bar is in the direction of this evolution.